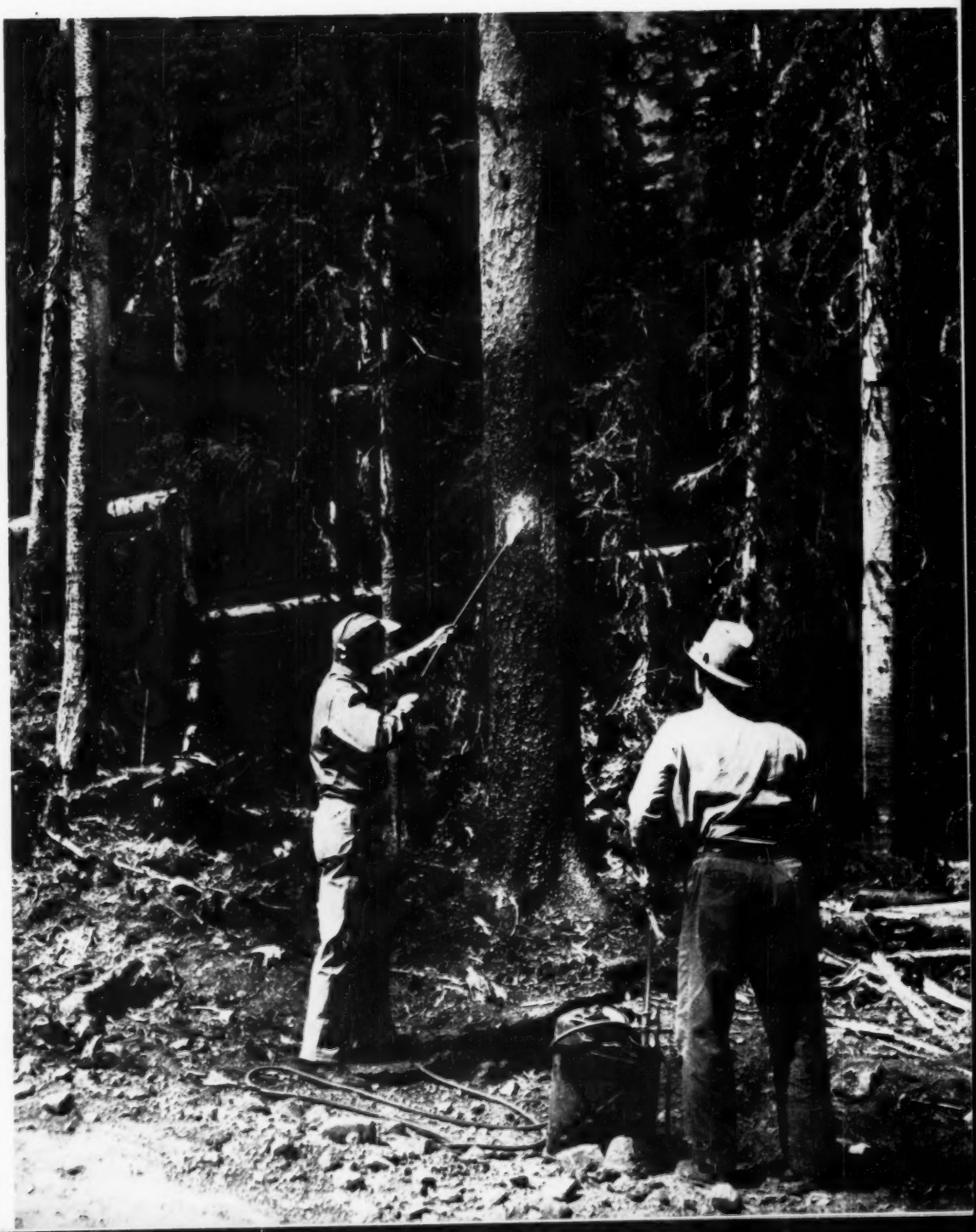
Journal of

FORESTRY

JULY 1954



SOCIETY OF AMERICAN FORESTERS 1900

Volume 52
Number 7

Well Balanc

All seams electric welded. No leakage.

Choice for Quality the World Over.

Send for latest catalog

INDIAN

"Nothing Compares to the INDIAN"

"There is no fire extinguisher that anywhere near compares with the **INDIAN FIRE PUMP**. Last summer we had two bad brush fires which were brought under control with **INDIANS** alone. The only available water we had was in the **INDIAN** tanks. The wind was blowing right toward the woods and six men killed the fire down with just their **INDIAN FIRE PUMPS**."

Ray C. Whitney,
Wilton, Maine

1949 Ford chassis Boardman-Built Fire Fighter; 500 GPM, 2 stage pumper purchased by the city of Bentonville, Arkansas. It is equipped with an INDIAN FIRE PUMP. Built by The Boardman Co., Oklahoma City, Oklahoma.

D. B. SMITH & CO.

407 MAIN ST.
UTICA 2, N.Y.

PACIFIC COAST BRANCHES:

Hercules Equipment & Rubber Company, Inc.
435 Brannan Street
San Francisco 7, California

Fred E. Barnett Company
2005 S. E. 8th Ave.
Portland, Oregon

Mill & Mine Supply, Inc.
2700 Fourth Avenue South
Seattle, Washington

Roy G. Davis Company
1355 S. Flower Street
Los Angeles 15, California

Fred E. Barnett Company
600 Spring Street
Klamath Falls, Oregon

L. M. Curtis & Sons
426 West Third Street South
Salt Lake City, Utah

CANADIAN AGENTS:

Fleck Bros. Limited
110 Alexander Street
Vancouver, B. C., Canada

C. E. Hickey & Sons, Ltd.
Hamilton, Canada

VOLUME 52 ● NUMBER 7 JULY 1954

Journal of Forestry

Editorial Staff

ARTHUR B. MEYER ..... *Editor*

HENRY CLEPPER ..... *Managing Editor*

L. AUDREY WARREN ..... *Business Manager*

Associate Editors

HAROLD H. BISWELL, *Range Management*, School of Forestry, University of California, Berkeley 4, Calif.

ROBERT R. BLUMENSTEIN, *Forest and Wood Utilization*, Timber Engineering Company, 4812 Minnesota Avenue N. E., Washington 19, D. C.

CHARLES C. BUCK, *Forest Fire*, California Forest and Range Experiment Station, P.O. Box 245, Berkeley 1, Calif.

JOHN W. DUFFIELD, *Silviculture*, College of Forestry, University of Washington, Seattle, Wash.

S. R. GEVORKIANTZ, *Mensuration*, Lake States Forest Experiment Station, University Farm, St. Paul 1, Minn.

MARVIN D. HOOVER, *Forest Influences and Soils*, Division of Forest Influences, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

HARVEY J. MACALONEY, *Forest Pathology and Entomology*, Lake States Forest Experiment Station, St. Paul 1, Minn.

RALPH W. MARQUIS, *Forest Economics and Policy*, Northeastern Forest Experiment Station, 102 Motors Avenue, Upper Darby, Pa.

CLARENCE W. RICHEN, *Forest Management and Engineering*, Crown Zellerbach Corporation, Public Service Building, Portland 4, Ore.

PHILIP C. WAKELEY, *Forest Genetics and Artificial Regeneration*, Southern Forest Experiment Station, 704 Lowich Building 2026 St. Charles Avenue, New Orleans 13, La.

LEE E. YEAGER, *Forest-Wildlife Management and Recreation*, Colorado Cooperative Wildlife Research Unit, 243 Forestry Building, Colorado A & M College, Fort Collins, Colo.

LLOYD THORPE, *Advertising Representative*, 604 Medical Arts Building, Seattle 1, Wash.

The JOURNAL OF FORESTRY, established in 1917, is the official organ of the Society of American Foresters, but the Society assumes no responsibility for the statements and opinions expressed by contributors.

Publication office, 425 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Address all correspondence concerning editorial or business matters to JOURNAL OF FORESTRY, 425 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Published monthly. Subscriptions $7.50 per year; single copies 75 cents. Missing numbers will be replaced without charge provided claim is made within thirty days after date of the following issue.

The editors are not responsible for loss or damage of manuscripts and photographs while in transit or in their possession. All material submitted for publication should be accompanied by return postage.

Copyright, 1954, by the Society of American Foresters. Entered as second-class matter at the post office at Washington, D. C. Acceptance for mailing at the special rate of postage provided for in the Act of February 28, 1925, embodied in Paragraph 4, Section 412, P. L. and R., authorized November 10, 1927.

CONTENTS

COVER: Englemann Spruce Bark Beetle Project Spraying. Arapaho National Forest, Colorado. *Photo U. S. Forest Service*

The Centennial of Professional Entomology in the United States — *Editorial* — 483

The Forest Service and Private Forestry — *W. S. Swingler* — 484

Root Collar Sprouts in Pine — *E. L. Stone, Jr.* and *M. H. Stone* — 487

Susceptibility of Larch to Red Squirrel Damage — *David B. Cook* — 491

Effect of Seedbed Condition on Paper Birch Reproduction — *Russell J. Hutnik* — 493

Hypoderma Needle Blight of Southern Pines — *John S. Boyce, Jr.* — 496

Floristic Analysis of Ground Cover Vegetation by a Rapid Chain Method — *S. A. Wilde* — 499

Control and Salvage Policy: Spruce Beetle Control in Colorado — *Arthur L. Nelson* — 503

Some Implications of the Spruce Beetle Control and Salvage Programs in Colorado — *Henry J. Vaux* — 506

Some Silvicultural Problems of the Northern Great Plains — *Ernest J. George* — 511

A Critical Look at Cloud Seeding — *Owen P. Cramer* — 515

Quail Management on Forested Land — *Phil Goodrum* and *V. H. Reid* — 518

Forest Research Developments in the Douglas-Fir Region — *C. W. Richen* — 520

Some Results of the Chemical Treatment of Trees to Facilitate Bark Removal — *Hugh Wilcox* — 522

Notes — 526

Tree Climbing Hint; A Uniform Service Test For Fence Posts; A Naturally Occurring Aspen Poplar Hybrid; Comments on "Leaf Litter as a Killer"; Comments on the Baker Automatic Tree Seed Planter.

Points of View — 532

The Master Degree: What is Behind a Title?

Reviews — 534

Forest Cover Types of North America; Economics of the Young-Growth Sugar Pine Resource; Proceedings of the Seventh International Botanical Congress (1950); Our Wildlife Legacy; Forestry Theses Accepted by Colleges and Universities in the United States, 1900-1952; New Green World; Decay Studies in Wooden Boats and Ships; Publications of Interest.

Current Literature — 538

Society Affairs — 539

Forestry News — 550

Index to Advertisers — 560

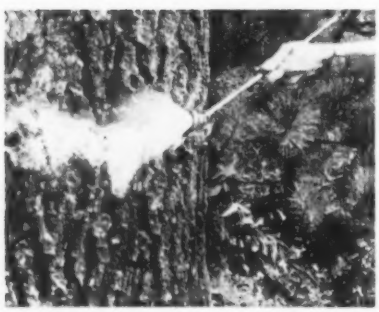
PINE SEEDLINGS and other high-value timber species mature in a short time after control of overtopping hardwoods gives them adequate room, air, sunlight, soil nutrients and moisture.

BASAL BARK TREATMENT requires all-around coverage of the basal area with Esteron 245 from the ground line upward 15 inches. Wet thoroughly until run-down or run-off is apparent.

ESTERON 245

EFFECTS LOW COST PINE RELEASE

Offers a positive means of removing hardwood competition to speed growth of seedling conifers



HARDWOODS 8 inches or over in diameter are controlled economically by cutting an axe frill through the bark all around the tree—and spraying the cuts with the brush killer.

A modern forest practice which is paying big dividends is chemical control of weed trees shading out young conifers, either as release or preplanting treatment. Using Esteron® 245, Dow's low-volatility 2,4,5-T ester brush killer, in frill or basal bark treatment kills oak, poplar and other unwanted trees which compete with the small conifers. Frill application is economical on larger trees, basal bark spraying on smaller ones. Both methods of application have proved effective over a wide range of hardwoods. Airplane spraying has been used successfully for large-scale release in areas where nearby farm crops are not a factor. We invite inquiries from state and federal foresters, lumber companies, pulp and paper companies and tree farmers. Dow sales and technical men are available for consultation and assistance. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan.

you can depend on DOW AGRICULTURAL CHEMICALS DOW

Journal of Forestry

Official Organ of the Society of American Foresters

The Centennial of Professional Entomology in the United States

WE recognize the fact that insects have an allotted place in nature's scheme and contribute to the Cycle of Life that nurtures us as physical beings. We know that some of them perform useful functions—like pollinating the blossoms of various plants. Yet, all in all, their capacity to throw things out of the balance judged most suitable for human existence seems to come to our attention more forcefully and more often than any good points which they may "accidentally" possess.

From a recent statement we learn that if all the world's insects were gathered together their total weight would exceed that of all other animal matter on the land surface of the earth. These insects, it was said, consume food equivalent to the producing capacity of 100 million acres of the world's soils, land that must support our present and future needs. These insects possess, too, the unfortunate characteristic of spreading deadly diseases that afflict humans and that could conceivably annihilate our race. They are a major enemy of America's forests.

Yet despite these ominous matters the average person goes blithely on his way, regarding insects as pests that sometimes spoil picnics or that have to be driven out of the kitchen sink occasionally by means of a squirt gun. He is not aware of the damage that would result were insects uncontrolled or of the many near-catastrophies that have been averted to his benefit. Even less is he aware of the present work and past attainment of the professional entomologists, a small group of men and women, who are very largely responsible for the fact that he can go happily on his way, oblivious to the chance of being engulfed in a swarming world of bugs. This group's number today in the United States does not exceed 4,500, but they may view with considerable pride the accomplishments of their profession during the past century. They have, in the tradition of the scientist, been more interested in their work than in their renown.

These entomologists have served in a capacity somewhat like that of the little Dutch Boy whose finger plugged up the dike. We look to them to save us, not only from the dire consequences of an insect-dominated world, but also to assure us of a healthy and reasonably uneaten, unstung existence.

In the year 1854 two entomologists, Townsend Glover for the federal government in the Patent Office and Asa Fitch for the State of New York, began studying the life histories and destructive habits of insects, giving special attention to those injurious to vegetation. Their findings served as a basis for the further development of entomology. Two other pioneers, C. V. Riley and L. O. Howard, broadened the scope of this science to embrace not only the observation and classification of insects, but also their control. Since that time the little publicized work of the professional entomologist has made immeasurable contribution toward the protection of our food, our health, and our possessions.

Consider what would happen to the average American home were there no methods of controlling termites, clothes moths, carpet beetles, house flies, and other insects whose names alone fill us with revulsion. Effective controls are the work of the entomologists.

A hundred thousand persons were killed by yellow fever in the United States prior to 1905. It was predicted in our earlier days that the scourge of malaria would prevent settlement of the Mississippi Valley and it was still a plague in parts of the South as late as 1930. Medical men demonstrated the connection between these diseases and the mosquito. Entomologists have shown how to prevent them by combating mosquitoes.

Apple growers have been able to reduce the destruction of the codling moth from 50 to 90 percent to less than 5 percent. Importation from Australia of a ladybird beetle saved the California citrus industry from ruin that threatened it in the form of the cottony-cushion scale. It is estimated that the control of livestock and poultry insect pests is responsible for a $100 million share of our annual meat, milk, eggs, and other animal products. Between 1938 and 1951, $900 million worth of food and livestock feed can be attributed to protection from the hungry grasshopper. Because insects were controlled an extra $4 million worth of soybeans were grown in an area of just 19 counties in Arkansas in 1953.

Health and food problems being of the utmost national urgency, it is easy to understand why early and continuing attention is shown them by the entomologists.

Entomologists have also aided many other human pursuits, including forestry. In common with

forest diseases, work on forest insects in the past has been largely a federal government function. As such it has been subject to the limitations of appropriated funds, a characteristic of which is "the unfortunate and uneconomic public and political attitude which appropriates great sums to meet an emergency after it has developed but withholds smaller appropriations which are essential if emergencies are to be reduced and eventually avoided."[1]

But despite such financial limitations, forest entomology has accomplished a great deal since the first appropriation was made in 1902 to the Bureau of Entomology for study of the Black Hills bark beetle outbreak. To enumerate the accomplishments of entomologists is impossible here; to measure their value is to conjecture on the vast damage that would have occurred without their work.

We must admit that forest entomologists in the United States and Canada have probably been handicapped in the past by our own attitude as foresters. Busy with other things, we have perhaps often missed the significance of "a few bug-killed trees." Not many of us would any longer be guilty of such an uninformed and short-sighted attitude, for as a profession we now recognize forest insects as a devastating agency on a par with fire.

Our hats are off to 100 years of professional entomology in the United States. We feel considerable satisfaction and pride in the increasing attention being devoted to insects by foresters, and to forests by entomologists.—AM

[1]Gisborne, H. T. Forest protection. In: Fifty years of forestry in the U. S. A. Society of American Foresters, Washington, D. C. 1950.

The Forest Service and Private Forestry[1]

W. S. Swingler
Assistant chief, U. S. Forest Service, Washington, D. C.

SIXTY-TWO YEARS AGO, some 400 people scattered throughout the United States asked for and received from the old Bureau of Forestry one packet of conifer seeds. This represents the first recorded cooperative effort between what is now the U. S. Forest Service and private individuals. Earlier efforts in timber management had consisted of lectures on forestry to various farmers' institutes in western New York, and to the School of Economics at the University of Wisconsin.

Presumably the practice of sending out these free packets of seeds continued but the next item of record came in 1898, seven years later. In October of that year, the Bureau of Forestry issued Bulletin #21 which outlined the terms under which the bureau would cooperate with farmers, lumbermen, and landowners in promoting better forest management. At that time, management and advice were given free for tracts under 200 acres. On larger tracts, the landowner was expected to pay the traveling and field expenses of the technical forester. The avowed purposes of this early cooperation were: (1) to create examples of cooperative management; (2) to show the advantages of management to both forest and owner over methods then generally followed; and (3) through publications, to spread as widely as possible a knowledge of the work and its results.

The idea evidently caught on, for by 1900 applications had been received from owners of 2½ million acres of forest land. Then, as now, the requests exceeded the available facilities and only about one-third of the land was actually examined. By 1906, one year after the Bureau of Forestry had become the Forest Service, requests for assistance in preparing plans for management had reached nearly 12 million acres. Only 2 million acres were actually examined due to the small number of technical foresters available for the job.

Five years later a significant statement was made which initiated a shift of responsibility for management examinations from Forest Service employees to the states and to private consulting foresters. I quote from the Chief's report of 1910:

> In the early days of the forestry movement, when no other source of advice was open, the Service used so far as was practicable to send its men to examine private tracts and give advice upon the ground. Now many of the states have foresters, and applicants in such states are referred to them. There are now also consulting foresters whom private owners of large tracts can and should employ. It is, however, still the policy of the Forest Service to help all applicants in every proper way. This is chiefly done by correspondence or conference. When there are a large number of applicants in a state which has no forester, and especially when they are owners of woodlots or small holdings, advice as to methods of management may be given upon the ground. This work, however, is intended to be educational in its scope, and is done with the expectation that all the states will eventually have foresters to look after it.

By 1912, agreements had been made with 25 state foresters to refer to them all requests for field examinations and detailed information. In other states, work was continued directly with small owners. Big owners were referred to private consultants where they were available.

I have gone this far back in the history in order to emphasize and point up two things: first, that the Forest Service from its very beginning has been interested in promoting good management on privately owned land; and second, that the Forest Service believed al-

[1]Presented at the annual meeting, Society of American Foresters, Colorado Springs, Colo., September, 1953.

most from the very beginning that the best way to promote good management of privately owned forest lands was through the state foresters and consulting foresters.

Since apparently there was so much interest in good forest management at the turn of the century, one might wonder why more progress was not made and why more evidence of this early interest and early efforts cannot be found on the ground. I think the answer to that is *fire*. I can well imagine the reactions of the landowner, who had a management plan made up for his property and made every attempt to follow its recommendations for several years, only to see a forest fire come along and destroy his stand. And with the prevalence of fires in those days, it is probable that something like this happened rather frequently.

It is therefore easy to understand why during the period from 1912 to 1924, the emphasis shifted from management plans and technical advice to fire protection. It was simply a case of putting the horse before the cart; of putting first things first. In any event, during that period with a few exceptions, the state organizations spent most of their time and effort in building up a fire protection organization and, in some cases, building up a system of state forests. Chief among the exceptions were Austin Hawes of Connecticut and Fred Besley of Maryland, neither of whom at any stage of the game lost their interest in making available advice and assistance to the private landowner. The work of the Forest Service in assisting private landowners also was at a low ebb during this period, and consisted of the freelancing of Austin Cary as he traveled around the country aiding and advising forest landowners. The national forest organizations also were of some limited help on those lands inside or adjacent to national forest lands.

This, then, was the picture of Forest Service and other public assistance to the private landowners at the time the Clarke-McNary Act was passed. Within a few years a new interest in management became evident. Section 5 of the Clarke-McNary Act expanded the system of extension foresters and these men were able to intensify their work of advising and assisting the farm woodland owners. Section 2 of the Clarke-McNary Act intensified protection from forest fires. As a result, the larger landowners, this time with little public help, again took an increasing interest in better management of their land.

Then came the depression and management activities on private land slowed perceptibly. I know of one coal company in the East that employed 12 foresters on its operations in 1929. In 1932, that company employed one forester. And so it went. No markets for the products, little income from the land, little efforts toward improved management.

Although things looked black during those depression days, several things happened that had a significant bearing on private forestry and on the contribution the Forest Service was able to make to the extension of better management of private lands. The first of these was the C.C.C., although the impact this program had on private forestry was not evident until some time later. The C.C.C. served as a training and proving ground for many young foresters. The C.C.C. also served as an inducement for other young men to study forestry. As a result, a relatively large pool of trained, capable foresters was available when the pulp industry began its expansion in the South, and when the large lumber companies decided to extend and intensify management on their forest lands. In fact, it was this large pool of men who did more than anyone else to sell the lumber companies and pulp companies on the idea that foresters and forestry had an important place in those industries. That they did have something to offer has been very well proved by the number who since have risen to the top or near the top of their organizations.

The second significant thing concerning the Forest Service and private forestry that occurred during this period was the creation in the Forest Service of a Branch of State and Private Forestry. Chief of the Service F. A. Silcox and Assistant Chief Ted Tinker presumably reasoned that with the great improvement in fire protection, the time had come to reactivate work in promoting good management on privately owned land. This was the period when Wahlenberg was engaged in his tax-depletion work in the West and when growth study plots and management plans were being prepared throughout the rest of the country. It was during this period that I joined up with the Forest Service and was assigned to the Northeast under the direction of Bob Evans and Gus Lentz. My job was to visit the brass of large land-owning companies and attempt to interest them in placing their holdings under management, and quite a job it was. In Maine, the work was relatively easy. There I could capitalize on the work Austin Cary did many years ago. In West Virginia and Kentucky, the going was really tough. There the lands were owned chiefly by coal companies and their main concern seemed to be only to make the timber last until the underlying coal was exhausted. In spite of that, every report I submitted to the companies invariably ended with a recommendation to hire a forester to manage their holdings. In 1939, there was as far as I know not a single industrially employed forester in West Virginia. According to latest reports, there are 30. I don't know how much credit for this can be placed upon my early work. I hope some. For I worked too hard not to be permitted the pleasure of thinking I at least prepared the ground, even though I may be the victim of an illusion.

The third and probably the most significant event that happened during the 1930's was the enactment in 1937 of the Norris-Doxey Act. At that time, the management assistance programs of all but a few states were nonexistent, or, at best, pretty weak. Prior to that time, a greatly understaffed Extension Service was practically

the only agency doing any work with the small landowner. After a few false starts, while we were attempting to learn the difference between farm forestry and forest farming, the Norris-Doxey program emerged in the familiar pattern of Forest Service-State Forester cooperation and from then on its progress was swift and sure. Today, many states with excellent private assistance programs have built these programs on the foundation of the Norris-Doxey Act. Here there is no chance for delusion, no question of the tie-in. Practically everyone recognizes that the present state programs for giving aid to the small landowners are the direct result of the Norris-Doxey Act. Today, in surroundings much different from those in 1891, the Forest Service is continuing its work in private forestry—and not alone as was then the case.

Forty-three states now have Clarke-McNary Cooperative Fire Control Programs. Nonfederal lands, 369 million acres, are receiving some degree of protection. The "Keep America Green", Smokey Bear, programs, and many private citizens are all working together toward better protection of our private forests.

Forty-five states, and many landowners, are now involved in the Cooperative Clarke-McNary Tree Planting Program. In 1952 over 300 million trees were distributed from state-operated nurseries. Pulp and lumber companies are distributing small trees to owners who want to plant idle acres. Some of these concerns own and operate nurseries. The Future Farmers, 4-H Clubs, Junior Chambers of Commerce, Garden Clubs, the More Trees Program, and Trees for Tomorrow are just some of the groups now interested in planting more of the 62 million acres of poorly stocked and denuded privately owned lands that should be growing commercial crops of trees.

Thirty-nine states with some 270 state-employed farm or service foresters are now providing on-the-ground technical advice and assistance in forest management and processing to owners of small forests and mills. In 1945, cutting was good on only about four percent of these small properties—it has been estimated that now somewhere around 15 percent of this small-owner acreage is under good management. There seems every likelihood that this improvement will continue at an accelerated pace, for within the past few years many others have been working with the small landowners. Consulting foresters, industry sponsored conservation foresters, programs such as Tree Farms, all are making a real contribution to better management on the small woodland.

Public participation in the protection of private forests from insects and disease has made slower progress than the other phases of private forestry I have discussed. Through cooperative efforts, several large outbreaks have been controlled recently. During the past several weeks the Council of State Governments has had under consideration a sample state law designed to strengthen state participation in this important field. A copy of this proposed law presumably will be sent to each state's attorney general this coming winter for possible consideration by the state legislatures.

As I noted, most of the work of the Forest Service in private forestry is done through the state foresters. There are, however, a few special jobs that the Forest Service still does directly. For example, we do a contract job for the Agricultural Conservation Program in the naval stores belt in the Southeast. There we are attempting not only to improve turpentine practices but also timber management practices. In Mississippi, we are doing a planting job in connection with flood prevention work. Probably the best known of our direct work is that done by that small group of highly specialized men working in very limited fields. We have a nursery specialist in the Southeast who is called upon by state foresters and industrial concerns to help with specialized nursery problems. In the Lake States we have a specialist presently working with four pulp companies owning some 800 thousand acres in the adoption of an electrographic process for a continuous forest inventory. Every one connected with these special jobs agrees that the work can best be done by the Forest Service, because no one state and no one company has full time need for such highly specialized talent.

Frankly, the Forest Service is happy that so many people and so many organizations are now interested in promoting better management on privately owned forest land. We have every reason to be interested in the programs of the state foresters, industry, 4-H Clubs, Chambers of Commerce, etc. This is a most natural interest because these programs are the very things the Forest Service has been hoping and working for these many years. The early leaders in the Bureau of Forestry have passed on. Were they alive today, I'm sure the present pattern of cooperation between federal, state, and private agencies and landowners would please them. It would be especially pleasing when they realized that this present day pattern has come about chiefly because all of us have insisted on following the policy of cooperation they first adopted back in 1910.

Root Collar Sprouts in Pine

E. L. Stone, Jr. and M. H. Stone
Department of Agronomy, Cornell University, Ithaca, N. Y.

In a previous report on dormant buds in pine (*10*) the basal buds and sprouts were excluded from consideration because of the diversity of opinion about them in the existing literature. The present paper is an account of the origin and subsequent development of buds in the vicinity of the root collar.[1,2]

Literature

The ability of certain species of pine to sprout following burning or mutilation of the seedlings and young trees is well known (*48, 9, 11*). In shortleaf pine (*Pinus echinata* Mill.), Mattoon (*6*) considered that such shoots were adventitious and arose from the upper portion of the root and lower stem. A photograph (*6*, Fig. 26) was entitled "Rare case of root suckers of shortleaf pine following injury to exposed root by fire." Illick and Aughanbaugh (*3*) described the sprouts of pitch pine (*P. rigida* Mill.) as originating from adventitious buds at the root collar where the stem and root system of the young tree meet. Pessin[3] reported formation of adventitious buds from the roots of young longleaf (*P. palustris*, Mill.) seedlings following removal of the tops, and his account was cited by Wahlenburg (*13*). Troop (*12*) in his memoir on chir pine (*P. roxburghii* Sarg.), referred to its ability to coppice from "collum" buds and to the formation of "protomorphic" shoots on saplings injured by fire. Without specific reference to the basal sprouts Büsgen and Münch (*1*) correctly referred to the stem sprouts of pitch pine as "preventitious" whereas Martinez (*5*) described as adventitious the shoots found on the stem of *P. chihuahuana* Engel., *P. leiophylla* Schl. and Cham., and *P. teocote* Schl. and Cham.

Cooperrider (*2*) described formation of buds in the axils of primary needles on juvenile seedlings of ponderosa pine (*P. ponderosa* Laws) following damage to the shoots by rodents. No buds developed on those seedlings severed below the cotyledons.

Observations

The basal buds in all species studied by the writers originate in the same manner:

As is generally known, young seedlings bear spirally arranged primary needles for some distance above the cotyledons. Near the end of the first to third growing season the "true" or fascicled needles develop in the axils of the upper primaries. The axil of each of the lower primaries likewise contains a potential meristem capable of producing a needle fascicle, a shoot or a dormant bud. In some species, such as white pine (*P. strobus* L.), these axils almost invariably remain blank whereas in Monterey pine (*P. radiata* D. Don) and others they produce an abundance of axillary shoots. In yet other pines, for example, Scots (*P. sylvestris* L.), loblolly (*P. taeda* L.), and slash (*P. caribaea* Morelet), a variable number of axils bear buds. Of these some elongate soon after formation whereas others remain more or less dormant for a time.

In the species discussed below small buds occur in the axils of the primary needles immediately above the cotyledons. Because of the close spacing of the needles at this point the buds may appear clustered or whorled after the stem has thickened. It is the buds of this zone particularly, and to a lesser degree from higher positions, that give rise to the basal or "root collar" shoots. In the material examined by us, all buds and sprouts could be traced back to their origin in the normal phyllotaxy of the stem and hence are in no sense *adventitious*.

Shortleaf Pine

Young seedlings of this species normally have a double crook variously termed S- or J-shaped near the base of the stem. The stem usually falls prostrate as shoot growth begins and then turns upward from a point just above the cotyledons, thus imparting the crook and leaving the cotyledonary area near the soil surface (Fig. 1). So characteristic is this habit that it can be used as an identifying feature with beds of nursery stock. (Rarely, under certain conditions of density and soil fertility, nursery grown seedlings may not bend.[4]) The crook was present in all natural seedlings observed by Mattoon (*8*) and the writers.

The lowermost primary needles almost invariably bear axillary buds and numerous buds are found above this zone as well (Fig. 1, 7). Although arranged spirally, the close spacing of the lower buds often gives the appearance of a cluster or a whorl just above the cotyledons. The upper crook of the stem commonly occurs at or above this bud cluster, leaving it near the soil surface. Further thickening obscures the junction of radicle and hypocotyl and gradually engulfs the short horizontal portion between the upward and downward crooks (Fig. 1, 2, 10). Rootlets from the uppermost root tissue arise in close proximity to the bud cluster which is often buried by soil movement or litter accumulation. Thus it is not strange that these buds and the subsequent shoots should have been thought to arise from root tissue

[1]The writers acknowledge with gratitude the assistance of A. A. Wood, supervisor of the Monongahela National Forest, and R. D. McCulley, Southeastern Forest Experiment Station, in obtaining seedlings of Table Mountain pine and pond pine.

[2]"Root collar" or "collar" designates the juncture of hypocotyl and primary root in seedlings; by extension it also describes the zone of contact between root and stem in larger trees. Although in general use, the term appears to have no exact morphological definition.

[3]Pessin, L. J. The sprouting ability of longleaf pine. Unpublished report on file, Southern Forest Experiment Station, New Orleans, La. 1932.

[4]According to the observation of P. C. Wakeley, Southern Forest Experiment Station.

(*6*). Sectioning, however, always demonstrates that their origin is in the stem.

Commonly some buds develop into shoots during the first few years but such shoots seldom attain appreciable size as long as the parent stem is growing normally. The remaining buds persist in a more or less dormant condition, sometimes giving rise to small clusters of fascicled needles. These clusters as well as apparently inactive buds may branch several times, considerably multiplying the original number of buds (Fig. 2). Injury to the stem, as from fire, grazing or cutting, provides a stimulus for elongation of these buds and often leads to abundant sprout production (Fig. 1, right, Fig. 10). Coppice or "seedling sprout" stands of this species are common (*6*, *7*, *8*). The sprouts themselves often bear numerous basal buds in the axils of the lower primary needles and, probably, from the axils of the parent bud scales as well. Such buds may remain quiescent until further injury occurs and then give rise to masses of sprouts (Fig. 10). An abundance of buds is essentially a characteristic of the young tree and the capacity to sprout usually disappears long before the tree reaches maturity.

Pitch Pine

The origin and behavior of the basal buds of pitch pine differ in no essential manner from those of shortleaf pine. A well-marked basal whorl is common although perhaps less so than in shortleaf pine and there is a greater tendency for development of strong lateral branches from the basal buds even in the absence of injury (Fig. 8). The basal buds, like those of the upper stem (*10*), often branch abundantly and bud clusters on older saplings often can be traced to a single origin in the first-year stem.

In an old-field stand near Ithaca, N. Y., distortion of the lower stem and root system by severe frost heaving brought about inversion of root and stem tissue so that bud clusters were found well below the point of attachment of lateral roots. Upon sectioning the stumps, however, the bud steles could be traced back to a normal origin in the first-year stem.

Pond Pine

The few seedlings of pond pine (*P. serotina* [Michx.]) examined are somewhat similar to those of pitch pine. A bend near the cotyledonary level is common. Usually some scattered buds can be found along the lower stem and a basal whorl is often, but by no means generally, present. The number of buds is increased and the appearance of a whorled arrangement augmented when the original buds are flanked by branch buds (Fig. 6).

Longleaf Pine

In their early years longleaf pine seedlings are characterized by very limited stem development and formation of a large thickened tap root (*13*). The hypocotyl is short and even in vigorous nursery seedlings the shoot above the cotyledons is no more than a thick conical stem, commonly ½ to 1 centimeter in length, closely set with primary needles.

Many of the lower primary needles, especially the lowermost, give rise to axillary buds (Fig. 11). Under favorable growing conditions a number of these buds elongate slightly and produce one or more fascicles laterally, thus becoming almost sessile branches (Fig. 12). On vigorous seedlings a considerable proportion of the fascicled needles arise in this manner, rather than directly from the main stem. Strong stimuli, such as mutilation, heavy fall fertilization or, occasionally, infection with Cronartium induce formation of both primary and fascicled needles from such buds (Fig. 4).

Bud formation is similar in natural seedlings but early elongation is less common because of slower seedling growth. Whether dormant or fascicle-bearing, the axillary buds persist in numbers for some years and commonly give rise to needles as described above. Following injury, as from severe burning or mutilation, the buds produce new needles and, if the leader has been destroyed, strong lateral branches (Fig. 9). The laterals that elongate as normal branches may bear additional buds in the axils of the first-formed primary needles.

Important as they are in survival of injured seedlings, these buds seldom persist long after height growth has begun. Only occasionally will saplings as large

---

FIGS. 1-12. Basal buds and sprouts in pine.

FIG. 1. Shortleaf pine seedlings with basal buds immediately above the cotyledonary area, buds higher on the stem and the typical crook. On the largest seedling the buds have expanded following injury.

FIG. 2. Basal section of a shortleaf pine, 3½ inches diameter, showing the branching of bud steles and their origin at the pith. (The plane of section follows the oblique course of the first-year stem and exposes steles at two levels).

FIG. 3. Section of a 3½ inch longleaf pine at the ground line. The external sprouts originated at the pith.

FIG. 4. Decapitated longleaf pine seedlings. The three at the left were severed immediately beneath the cotyledon scars whereas the remainder were cut above or diagonally through the cotyledon area.

FIG. 5. Slash pine seedlings showing unexpanded buds (arrows), developing buds and small lateral shoots.

FIG. 6. Pond pine seedlings. The original buds are flanked by daughter buds (arrows).

FIG. 7. First-year shortleaf pine seedlings showing buds in the primary needle axils. (The stems bend below the cotyledon scars and pass out of the photographic plane.)

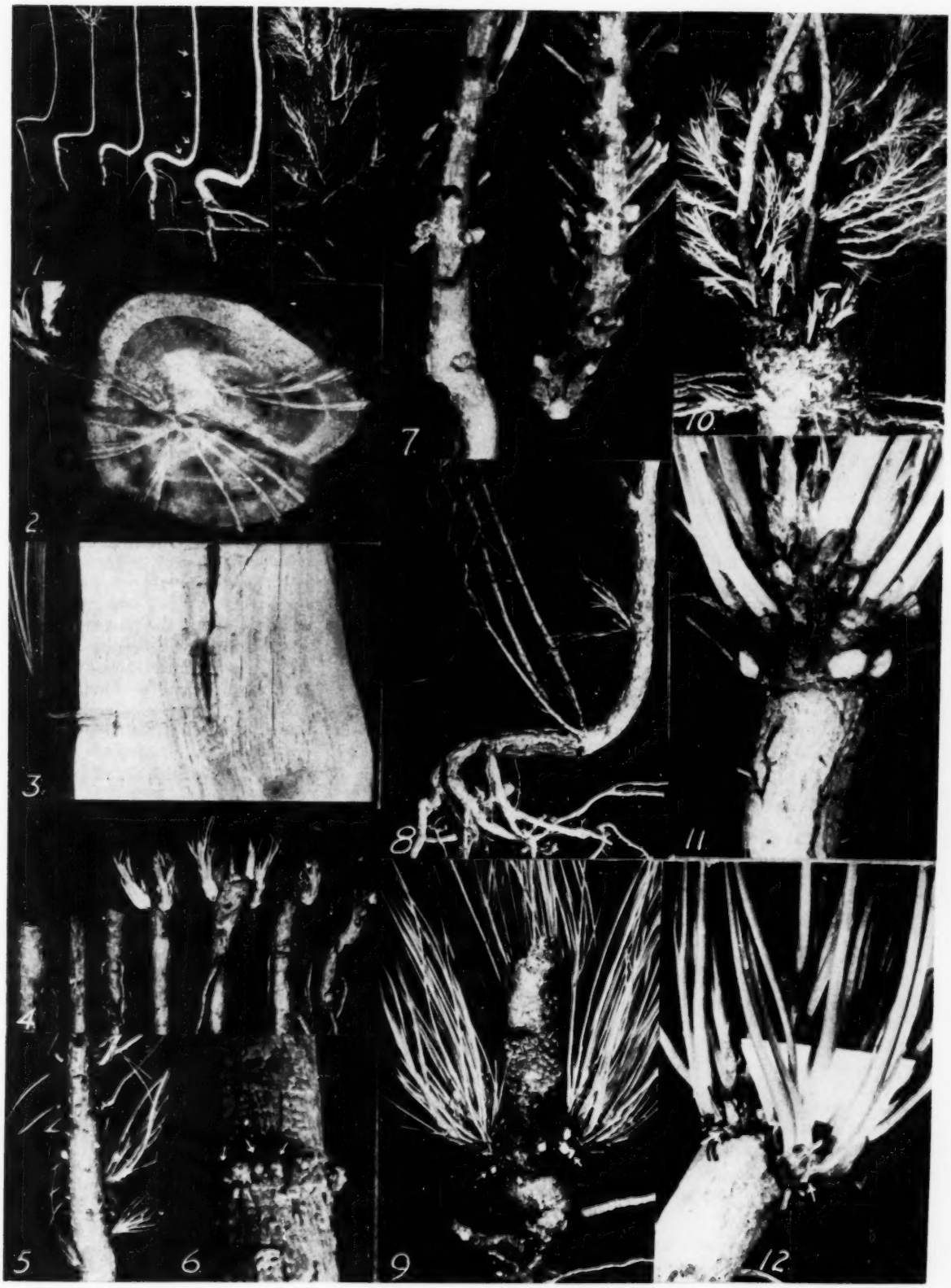
FIG. 8. Pitch pine seedling. Some of the buds in the basal whorl have elongated, the others remain dormant.

FIG. 9. Longleaf pine seedling about 1 inch in diameter. The short vigorous shoots from basal buds are replacing the fire-killed top. Additional buds are expanding (arrows).

FIG. 10. Shortleaf pine 1½ inches diameter. Removal of the top has stimulated elongation of shoots from buds on the lower stems and branches.

FIG. 11. Nursery-grown longleaf pine seedling. The basal buds are expanding following fall fertilization.

FIG. 12. Nursery-grown longleaf pine seedling. The basal buds have produced minute lateral branches (arrows) bearing fascicles and buds.


2
3
4
5
6
7
8
9
10
11
12

as 2 to 4 inches d.b.h. be found with needle clusters near the ground line (Fig. 3).

Pessin reported on the sprouting of young longleaf pine seedlings cut off with a grub hoe in the course of a thinning experiment. Since it was believed that the cuts had been made below the ground line, the buds were assumed to have arisen adventitiously from the roots. The writers, however, have never observed buds of adventitious origin despite examination of a large number of seedlings, natural and nursery reared, with particular attention to those injured, diseased, and with exposed roots. Further, in decapitation experiments seedlings invariably failed to produce buds if severed at or below the cotyledonary level, whereas when seedlings were severed slightly above, or even diagonally through this level the small axillary buds elongated promptly (Fig. 4). Finally, close examination of the photographs in Pessin's original report strongly suggests that the seedlings figured were actually cut off above the cotyledonary level, with sprouts then arising from stem tissue. In this region localized soil movement and deposition commonly follow the frequent fires and it is quite possible that the cotyledonary zone of the seedlings described by him was actually below the existing soil surface.

Table-Mountain Pine

The occurrence of basal buds in Table-Mountain pine (*P. pungens* Lamb.) somewhat resembles that observed in pitch pine. A complete whorl of basal buds is less common but usually there are one or more buds near the cotyledonary level and additional buds often appear as a quasi-whorl an inch or so above this point. Unlike those in pitch pine the basal buds in Table-Mountain pine seem to elongate readily only under the stimulus of injury. Some of the buds appear to be short lived but the sprouting of cut stumps of large trees noted by Sudworth (*11*) suggests that others persist.

Virginia Pine

As seen in southern Pennsylvania this species, *P. virginiana* Mill., bears a very few axillary buds immediately above the cotyledons. These commonly elongate during the second year, often producing shoots with crowded primary needles which may in turn bear additional buds.

Buds also occur occasionally in primary needle axils on the lower part of the second-year shoot. Further, fascicle buds are readily produced when the tips of even weak branches are destroyed. Thus, in this species there are several possible origins for shoots from the lower stem, although none are adventitious.

Other Species

The descriptions and photographs in Troup's monograph (*12*) on chir pine reveal the presence of abundant buds on the lower seedling stems. These presumably originate as described above. Although Chihuahua pine (*P. leiophylla* var. *chihuahuana* [Engel.] Shaw) has not been examined by us, it is reported to sprout freely from the stump (*9, 11*) and in all likelihood the sprout origins resemble those of pitch and shortleaf pine. As mentioned, numerous shoots arise from the primary needle axils of Monterey pine seedlings but no instances of continued axillary bud dormancy were noted under greenhouse conditions.

Since all axils are potential sites of bud formation the seedlings of a number of species at least occasionally bear such buds (Fig. 5). It is only when these are numerous and remain dormant for some years that a species comes to be noted for its sprouting ability.

Significance in Forestry

In nursery-grown longleaf pine an appreciable proportion of the fascicled needles is borne on minute "branches" from the basal buds, rather than on the primary stem as generally believed. Repeated mention has been made of the role of the basal buds in the survival of seedlings injured by fire, grazing, cutting, etc. The occasional sprouting or coppicing of saplings and larger trees when cut is perhaps of more interest than importance silviculturally. Seedling sprouts, however, often develop into well-formed trees and many acceptable stands of pitch, shortleaf and longleaf pine are known to have originated thus. Basal sprouting is by no means uncommon among the hard pines but its likelihood is very largely determined by bud formation on the stem of the first-year seedlings; few buds arise thereafter.

Summary

Study of seedlings and stem sections demonstrates that the "root collar" sprouts of pines arise from buds formed in the axils of the primary needles. Generally the buds are most abundant in the axils immediately above the cotyledons. Once formed they may elongate immediately or remain more or less dormant for some years. No adventitious buds were found. Distortion of the lower stem, however, which is often concealed by subsequent growth, may result in buds occurring near or below lateral roots and hence the common assumption that such buds have arisen from root tissue.

Literature Cited

1. BÜSGEN, M., and E. MÜNCH. 1931. The structure and life of forest trees. English translation by Thomas Thompson. John Wiley and Sons, New York.
2. COOPERRIDER, C. K. 1938. Recovery processes of ponderosa pine reproduction following injury to young annual growth. Plant Physiol. 13: 5-27.
3. ILLICK, J. S., and J. E. AUGHANBAUGH. 1930. Pitch pine in Pennsylvania. Penn. Dept. Forests and Waters, Research Bul. 2.
4. LUTZ, H. J. 1934. Ecological relations in the pitch pine plains of southern New Jersey. Yale Univ. School of Forestry, Bul. 38.
5. MARTINEZ, MAXIMINO. 1945. Las pinaceas Mexicanas. Mexico, D. F.
6. MATTOON, W. R. 1908. The sprouting of shortleaf pine in the Arkansas National Forest. Forestry Quart. 6: 158-159.
7. ———. 1915. Life history of shortleaf pine. U. S. Dept. Agric. Bul. 244.
8. MOORE, E. B. 1936. Seedling-sprout growth of shortleaf and pitch pine in New Jersey. Jour. Forestry 34: 879-882.

9. SHAW, G. R. 1914. The genus *Pinus*. Publications of The Arnold Arboretum No. 5. Riverside Press, Cambridge.
10. STONE, JR., E. L., and M. H. STONE. 1943. Dormant buds in certain species of Pinus. Amer. Jour. Botany 30: 346-351.
11. SUDWORTH, G. R. 1917. The pine trees of the Rocky Mountain region. U. S. Dept. Agric. Bul. 460.
12. TROUP, R. S. 1916. *Pinus longifolia* Roxb.; a sylvicultural study. Indian Forest Memoirs, Sylviculture Series Vol. 1, Pt. 1.
13. WAHLENBERG, W. G. 1946. Longleaf pine. Pack Forestry Foundation, Washington, D. C.

Susceptibility of Larch to Red Squirrel Damage

David B. Cook
Cooxrox Forest,
Stephentown Center, N. Y.

THE RED SQUIRREL IS ONE of the best known denizens of our North American forests, where its range extends from coast to coast. It inhabits stands of conifers and mixed woodlands in which evergreens are an important component. In the Northeast, most of the range is occupied by the subspecies *Tamiasciurus hudsonicus loquax*. The food of this squirrel includes items of flesh, insects, and toadstools, but is largely the bark, seeds, and buds of conifers. The habit of cutting and storing cones for winter use is well known. In order to feed more easily and safely upon the buds, this agile little rodent cuts off leaders, twigs, and small branches. Pine, spruce, and larch are most frequently attacked.

The native tamarack *(Larix laricina)* of the northern states is rarely bothered but two widely planted exoties, European *(L. decidua)* and Japanese larch *(L. leptolepis)* have been reported as susceptible to squirrel injury. On larch, the trimming is mostly confined to the smaller twigs, usually those of the current year's growth. Ordinarily, it is not heavy enough to be of consequence, and is soon outgrown, but repeated attacks may so thin the crown as to reduce both diameter growth and general vigor. In extreme cases, the tree may be cut down to a mere pikepole or to a stubby, misshapen runt. Hosley *(1)* has fully described such attack upon European larch at the Harvard Forest, Petersham, Massachusetts. Squirrel cutting of larch has also been reported from Connecticut, New York, and Michigan. In Sweden, larches are attacked by the European red squirrel *(Sciurus vulgaris)* and the injury is bark gnawing on the leaders rather than twig cutting. Damage probably results wherever larches and hungry squirrels occur together.

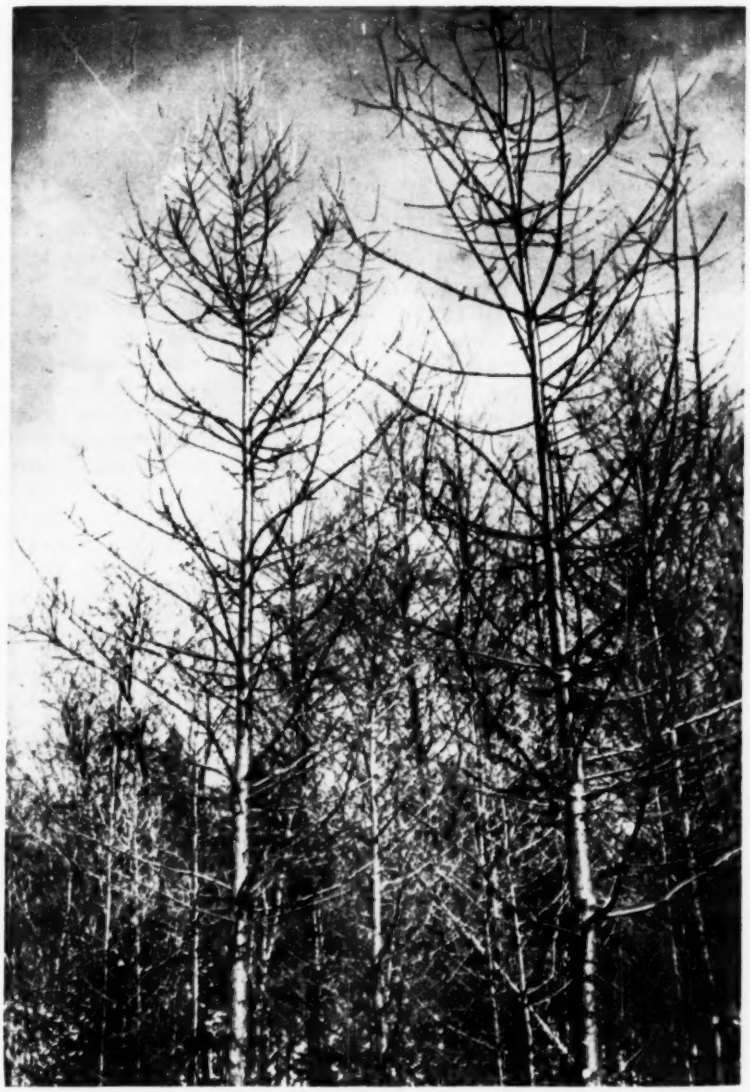


FIG. 1.—European Larch of Scotch origin severely trimmed by red squirrels. Stephentown, New York, 1952.

There appears to be considerable difference in susceptibility to squirrel attack, not only between

the species of larch but also between the several races of European larch, at least when planted in the Northeast. Regarding this problem in Sweden, Schotte *(3)* says that "Squirrels, especially, seem to love the European larch" . . . and . . . "prefer trees whose diameter at breast height varies between four and six inches." At two stations in Sweden, "the Siberian larch suffers the most damage." McCulloch *(2)* indicates that, in Michigan, Japanese larch was heavily attacked while European was left unharmed.

This present report covers observations on the relation of the red squirrel to several plantings of larch growing at Cooxrox Forest in east central New York. This forest is an especially good site for larch and also supports a large population of red squirrels. Frequent observations of the larch plantations have made possible a continuing appraisal of the intensity and duration of squirrel attack. The damage is best seen in late winter, when the cut twigs are conspicuous on the snow or on the bare ground. Also, this is the season when pruning operations require a tree-to-tree inspection of the stands.

Observations

A number of plantations, each composed of Japanese larch or of a single race of European larch, have been under observation. Whenever squirrels are present, all races of European larch show squirrel cutting in some degree, the intensity of attack apparently depending not only on the squirrel population but also on the distance from their home stations and the relative abundance of other and more preferred foods. However close the proximity to favorable squirrel habitats, no case has been observed of twig cutting on Japanese larch. Comparative data are most convincing in mixed plantations where two or more species or races are growing together and so are equally exposed to attack.

Plantation No. 30 is a 12-year old stand of Japanese larch with a single European larch near the corner next to the road and to a stone wall, and a group of scrub apple trees where red squirrels are always present. On two occasions, this lone European has been severely trimmed, while the surrounding Japanese have been untouched.

Even more conclusive is Plantation No. 23, 17 years old, composed of Japanese larch and of the Silesian and Scotch races of European. The Scotch larches have been so heavily and so repeatedly cut by squirrels that they are unthrifty, with ragged crowns composed of shortened and irregular branches. The Silesian component is of much better form and growth. Although it has suffered some damage, the trees are considerably taller than even the best of the Scotch and perhaps half again as large in diameter. The Japanese are by far the finest trees in the stand; a little taller than the Silesians but much greater in girth. They show no sign of twig cutting. It is apparent that this is deliberate selection on the part of the squirrels, for their signs are abundant throughout this and adjacent plantations and in the surrounding natural woodlands.

Other interesting observations have to do with Dunkeld larch No. 25, a 16-year old planting of the hybrid between Japanese and European larch, *Larix eurolepis*. This F_3 generation material exhibits the usual variation. Those trees that show, in their finer branching and yellow twigs, a preponderance of European characteristics are the only ones clipped by squirrels, even though they are intimately mixed with intermediate and Japanese-like individuals.

One small group of Dahurian larch *(L. dahurica)* has shown no signs of squirrel work, even though it is surrounded by habitat favorable to this rodent.

Conclusions

On the basis of these observations, limited in area but covering the whole life of the plantations, it would seem that Japanese and Dahurian larch are practically immune to attack by squirrels, whereas European larch commonly suffers from twig cutting. In the latter species, the Silesian race appears to be less susceptible than the Scotch, which may be critically hurt by heavy and repeated trimming. This emphasizes the necessity for great care in the selection of species and races of larch for planting in the Northeast.

Literature Cited

1. HOSLEY, N. W. 1928. Red squirrel damage to coniferous plantations and its relation to changing food habits. Ecology 9(1):43-48.
2. MCCULLOCH, W. F. 1937. Red squirrels attack Japanese larch. Jour. Forestry 35(7):692-693.
3. SCHOTTE, GUNNAR. 1930. Larken och dess betydelse for Svensk skogshushallning. Copenhagen.

Effect of Seedbed Condition on Paper Birch Reproduction

Russell J. Hutnik[1]
Research forester, Northeastern Forest Experiment Station

Paper birch (Betula papyrifera *Marsh*) *is widely used in the manufacture of specialty products such as toys, toothpicks, bobbins, and crutches. In recent years demand for paper birch has increased. At the same time, the available supply of paper birch is decreasing. Dieback is killing much of it. Logging and normal mortality are gradually eliminating it from mixed stands, because it is short-lived and intolerant. And less land is reverting to paper birch. Even now there is a shortage of high-quality paper birch boltwood in many areas.*

PAPER BIRCH is a pioneer species. It comes in after land abandonment or after the site has been radically disturbed by fire, logging, or windthrow. These stands of paper birch—pure or in mixture with other species—are temporary in nature; they usually last only one generation. More tolerant species replace them.

Fewer and fewer areas have been reverting to paper birch. Oddly enough, this has resulted largely from the gradual improvement in our agricultural and forestry practices. As the agricultural economy has become stabilized, land abandonment has dropped sharply. Aside from exceptional years such as 1947, the area of forest land burned over has declined steadily. And silvicultural systems other than clear-cutting have come into greater use.

So now the supply of paper birch is falling and the demand for it is rising. This situation puts before us a major management problem: How to regenerate paper birch?

A Study of Reproduction

A study of the factors that affect establishment of paper birch reproduction was made in various parts of the Northeast in 1951. This study included a survey of existing stands to find out why paper birch has become established in some areas but not in others.

The survey was limited to young stands. In old stands it was difficult to reconstruct the conditions that existed when the stand became established.

The term "established reproduction" used in this report means those paper birch seedlings that have lived through at least one growing season.

Forest Seedbed Conditions

Condition of the seedbed is one of the most important factors that affect establishment of paper birch reproduction, the study showed. Mineral soil provides the best seedbed conditions. Survival is better on mineral soil because it does not dry out so fast as other surfaces; the moisture supply is partly replenished from below through capillary action.

Abundant paper birch reproduction was also observed on well-developed mor and mull humus layers. But during extended dry periods humus layers, especially of the mor type, may become excessively dry. As a result, many small 1- and 2-year-old seedlings whose roots have not yet reached mineral soil die.

The seedbed condition that most frequently seems to prevent establishment of birch seedlings is the hardwood leaf litter and the partially decomposed matted leaf layer beneath it. A detailed study made in a small opening within a cutover area near Norway, Maine supports this.

Here the abundance of 1-year-old paper birch seedlings on areas where the litter and the matted leaf layer had been removed was compared with that on undisturbed areas. Twelve 1-milacre plots were chosen at random in this opening. The area in each of the two seedbed conditions was mapped, and the number of paper birch seedlings was recorded. Paper birch seedlings were almost 30 times as numerous on the disturbed area (Table 1).

To study this effect further, an experiment was set up on the Bartlett Experimental Forest at Bartlett, New Hampshire, in the fall of 1951. Twelve 1-milacre plots were laid out in an opening in a 70-year-old paper birch-red maple-aspen stand. The opening was created by a logging operation in 1945.

The plots were grouped into three blocks of four plots each. The following seedbed treatments were randomly assigned to each block: (1) mineral soil exposed by removing all the litter and humus, (2) humus layer exposed by removing the leaf layers, (3) burning, and (4) an untreated check.

Many more paper birch seedlings were found on the mineral soil and humus plots than on the untreated plots (Table 2). The difference between the number of seedlings on the mineral-soil and on the humus plots is not statistically significant.

In general, reproduction on the burned-over plots was unsatisfactory. The probable reasons for this will be discussed later.

The reasons why the hardwood leaf layers hinder the establishment of paper birch reproduction were not studied. However, we do know that the surface of the leaf litter is subject to greater temper-

TABLE 1.—EFFECT OF LEAF LAYER ON ESTABLISHMENT OF PAPER BIRCH SEEDLINGS

Condition	Area	Seedlings established	
		Total	Average per milacre
	Milacres	*Number*	*Number*
Leaf layer removed	2.2	781	355
Leaf layer present	9.8	120	12

[1]Forest Service, U. S. Dept. Agric. Mr. Hutnik is a member of the Experiment Station's research center at Laconia, N. H.

ature extremes than a mineral soil or humus surface. Occasionally the excessive heat could prevent germination or kill the seedlings whose tissues have not hardened.

The hardwood leaf litter may also act as a physical barrier. In areas where the litter is thick, the young seedling may use up its reserve food supply before it can break through the litter layer and manufacture its own food.

Another possibility is that the radicle of the germinating paper birch seed simply cannot push through the tough hardwood leaf layer. We found that softwood litter is somewhat less a barrier than hardwood litter.

Effects of Forest Fires

The densest stands of paper birch were found on areas that had been swept by forest fires. Forest fires improve the seedbed by removing the leaf litter. They also change much of the nutrient supply into a more readily available form. This fertilizing effect may also help to bring about more suitable conditions for seedling development.

Forest fires do not necessarily insure a new stand containing a high proportion of paper birch. In dense stands, the competing vegetation and crown cover may remain intact after a light fire. In such places there will be little or no reproduction of the intolerant paper birch, even though seedbed conditions may be improved.

Light ground fires that consume only part of the litter are of little value in improving seedbed conditions. In the Bartlett experiment, only a small number of paper birch seedlings were found on the burned-over plots (Table 2). This poor catch is due mostly to the lightness of the burn on these plots. Only the upper layer of leaf litter was burned off. In fact, atmospheric and litter conditions were so unfavorable that we had to use kerosene to keep the fire burning.

(This experiment will be repeated without kerosene at some future date when burning conditions are more favorable.)

At the other extreme, exceptionally severe fires seem to deter the establishment of paper birch. This was borne out by observations on the Massabesic Experimental Forest near Alfred, Maine. In October 1947 a fire swept over most of the forest. The fire was particularly intense on an area that had been logged over a short time before.

After the fire, the mineral soil was exposed over much of the area, and there were many seed trees nearby. Yet very few paper birch seedlings became established. By 1951 the vegetation on this area consisted merely of grasses, sweet fern, and scattered clumps of gray birch. In contrast, paper birch reproduction was very dense on a similar adjacent area where, because of the absence of logging slash the fire had been less intense.

Furthermore, even though the available amount of essential nutrients increases when the litter burns, the total amount—available plus unavailable—decreases. Intense or frequent fires may impoverish the soil.

Abandoned Agricultural Land

Case histories of a number of paper birch stands of various ages were studied in northern New England and New York. We found that many of these stands originated after the abandonment of agricultural land. Many former pastures now support dense stands of paper birch. But former hayfields were not so favorable. Most of these still have a grass cover with only scattered clumps of trees.

The competition from well-established grasses apparently prevents paper birch from coming in on some abandoned agricultural land. The pastures had thin sod and many bare patches when they were abandoned. Hayfields, on the other hand, usually had a heavy sod; and few paper birch seedlings were able to survive in competition with the rank growth of grass and weeds. Most of the paper birch that did become established on old hayfields came in under the crowns of saplings where there was little or no competition with grass. However, because of the intolerance of paper birch, they had to push their crowns into the sunlight in order to survive.

A heavy cover of Polytrichum moss also prevents the establishment of paper birch. Such cover is common on wet sites in abandoned pastures. Drier sites do not support so dense a cover of this moss, and paper birch seedlings are able to compete successfully there.

TABLE 2.—EFFECT OF SEEDBED TREATMENTS ON PAPER BIRCH REGENERATION, IN NUMBER OF 1-YEAR-OLD SEEDLINGS PER MILACRE

Block	Treatment			Untreated check plots
	Mineral soil exposed	Humus exposed	Burned	
	Number			
1	35	43	9	2
2	43	13	5	0
3	30	6	1	0
Total	108	62	15	2

Other Factors

This discussion has been based on the effect of a single factor—seedbed condition—with the assumption that all other factors are favorable for the establishment of paper birch reproduction. But this is seldom true.

In forest stands we must also consider the influence of light, soil, aspect, slope, moisture, seed source and supply, competition from advance reproduction and sprouts of other species, and geographical location of the area. A detailed study of the effects of these individual factors, although desirable, is difficult to make. We can seldom find two areas alike in all respects except the one factor we want to study.

Of these factors, light is one of the most important, and its effect is probably the easiest to determine. For given localities and their

conditions we should be able to find the answers to these two important questions: (1) What size opening is necessary to get paper birch reproduction? and (2) Under what density of crown cover can paper birch seedlings become established and compete successfully with seedlings of other species?

Recommendations

From this study, a few preliminary recommendations can be made. Although there is no sure way to get paper birch reproduction, a treatment that removes the overstory and exposes the mineral soil will create good seedbed conditions for it.

In carrying out the cutting, the soil should be disturbed as much as possible—short of encouraging erosion. In other words, do the skidding in the summer, preferably with a tractor. The greater the area in skid roads and trails, the better the chance of getting paper birch reproduction.

In certain areas disking may be the best way to regenerate understocked stands to paper birch. In a recent study in northeastern Wisconsin, a stand of more than 300,000 seedlings per acre became established on disked strips within 1 year after disking.[2] More than 90 percent of these seedlings were paper birch. On the undisked area, almost no seedlings became established.

Clearcutting followed by controlled burning would probably create the most favorable seedbed conditions for paper birch. However, the author agrees with Nash and Duda[3] that, "It can hardly be advocated, however, until fire extinguishing is more positive and the public frame of mind regarding woods fires is ready to accept it." In the meantime, research is needed to find out if fire can be used for this purpose.

Summary

In the Northeast, mills that manufacture specialty products from paper birch are faced with a serious shortage of raw material. This shortage is largely due to gradual elimination of paper birch through logging and mortality, without corresponding areas reverting to paper birch stands.

Why does paper birch become established in some areas but not in others? The condition of the seedbed is part of the answer. This was brought out by study of a number of stands in various parts of the Northeast. This study indicated that:

1. The hardwood leaf litter and the matted leaf layer beneath it especially hinder the establishment of paper birch reproduction.

2. An exposed mineral soil seedbed is desirable. Occasionally humus layers also have good catches of paper birch reproduction.

3. Dense stands of paper birch often follow forest fires. Fires improve seedbed conditions by removing the leaf litter and the competing plants. Very light fires and very severe fires, however, are of little or no value in improving seedbed conditions.

4. On abandoned agricultural land, competition from well-established grasses or dense moss often prevents paper birch reproduction. For this reason, paper birch is more common on abandoned pastures than on old hayfields.

As yet there is no sure way of getting paper birch reproduction. But by completely removing the overstory and exposing the mineral soil, we can create good seedbed conditions. This can be done by clearcutting, summer logging, tractor skidding, disking, or even controlled burning. Additional research is needed on the regeneration of paper birch.

[2]Stoeckeler, J. H. Disking to regenerate pulpwood species. Lake States Forest Expt. Sta. Tech. Note 372. 1 p. 1952.

[3]Nash, Robley W., and Edward J. Duda. Studies on extensive dying, regeneration, and management of birch. Maine Forest Service Bul. 15. 82 pp. 1951.

Hypoderma Needle Blight of Southern Pines

John S. Boyce, Jr.[1,2]
Associate pathologist
Asheville, N. C.

NEEDLE BLIGHTS of hard pines occur periodically during early spring in the southeastern United States. At these times the off-colored foliage is very noticeable and it has aroused the concern of forest managers. The investigations herein reported confirm by inoculation experiments that the fungus *Hypoderma lethale* Dearn., long regarded as parasitic to southern pines, is a primary cause of this needle blight, termed Hypoderma needle blight.

Symptoms of the Disease

Hypoderma needle blight is characterized by the dying back of infected needles. All or only some of the needles on a branch may be affected and, commonly, more needles in the lower crown of a diseased tree are blighted than in the upper crown. The needles of large trees as well as of seedlings and saplings may be involved.

Initially the individual needles turn brown back from their tips, while the basal portions remain green. At this stage tufts of diseased needles often appear to have been dipped in brown dye so that the tips are uniformly brown. Later, some needles turn entirely brown. Needles in various stages of dieback may be shed prematurely.

Needles infected with *Hypoderma lethale* during the summer change color rather suddenly late in the following winter and early spring before new needle growth begins. For example, the 1951 needles of diseased pitch pines at Asheville, North Carolina, bore indefinite discolored spots on March 21, 1952. By April 11, the tips had died back to typical Hypoderma lesions.

Hypoderma lethale infection may be diagnosed before the appearance of its fructifications by the presence of broad encircling bands up to several centimeters long. These bands represent the initial areas of infection. At first they are reddish-brown and are separated by green needle tissue. Later, they become straw-colored to grayish-brown and the intervening needle tissue turns brown. This results in a "mottled" effect.

Lengthwise wrinkles form in the needle epidermis at the infection spots early in the spring. They contain fungus hyphae between the epidermis and the hypoderm; these hyphae are visible microscopically when infected material is sectioned and stained. Minute, oval- to rod-shaped bodies of uncertain function are produced in these structures. These bodies have not been observed to germinate; therefore, it is unlikely that they disseminate the fungus. It is possible that they function in the fertilization process preceding ascospore formation.

The fruiting bodies, or hysterothecia, appear in late spring and early summer. They often form in the epidermal wrinkles described above. The hysterothecia are narrow, black pustules which, when mature, open by means of inconspicuous lengthwise slits to discharge ascospores when they are moistened.

Distribution of Hypoderma lethale

Many needle-blighted trees were examined in the Southeast in the spring of 1949, 1950, 1951, and 1952. In 1951, for example, *Hypoderma lethale* occurred in 93 of a total of 118 collections. The brown-spot fungus (*Scirrhia acicola* [Dearn.] Siggers) was responsible for needle blight in 9 instances, and 16 cases of needle browning, involving mostly pond pines (*Pinus serotina* Michx.), were of unknown origin.

Pines of many sizes were observed to be infected with *Hypoderma lethale* during these years. The diseased trees occurred singly and in groups on both good and poor sites. Severely blighted trees were often found next to healthy individuals.

The writer has collected *Hypoderma lethale* on the following pines in the Southeast: *Pinus elliotti* var. *elliotti* in Florida, Georgia, and South Carolina; *P. echinata* Mill. in North Carolina and South Carolina; *P. pungens* Lam. in North Carolina; *P. rigida* Mill. in North Carolina and Virginia; *P. serotina* Michx. in Georgia and North Carolina; *P. taeda* L. in Georgia, North Carolina, and South Carolina; and *P. virginiana* Mill. in North Carolina and Virginia.

Darker *(3)* and Hedgcock *(5)* have also indicated the prevalence of *Hypoderma lethale* on hard pines in the eastern United States. No record is known of its occurence on longleaf pine *(Pinus palustris* Mill.)

Damage

Although the effect of Hypoderma needle blight on tree growth was not measured quantitatively, some general observations were made of damage. At the time of collecting diseased needles from 68 scattered Hypoderma-infected trees in Georgia and the Carolinas in the spring of 1951, a tally was made of the amount of dead foliage on them. The crown of each tree was divided into lower, middle, and upper third parts and the total dead needle tissue within each zone was estimated by inspection. An average of 40 percent of the needle tissue per tree was dead. Within the crowns, averages of 47 percent, 39 percent, and 24 percent of dead foliage were obtained for the lower, middle, and upper third parts, respectively. This estimate of dead foliage was applicable only to those conspicuously blighted trees, and many trees with less blight were not estimated.

[1]The author is indebted to R. V. Maleeki of the Union Bag and Paper Corporation, Savannah, Georgia, for help in collecting specimens and selecting observation trees.

[2]Division of Forest Disease Research, Forest Service, U. S. Dept. Agric., Southeastern Forest Experiment Station.

There is also limited evidence that suggests that pines may be reinfected each year. All 20 of the trees that were marked for observation because they were infected with *Hypoderma lethale* in the spring of 1951 were again diseased in 1952. Four loblolly and 7 slash pines on the coastal plain, and 7 pitch, 1 shortleaf, and 1 Virginia pines in the mountains at Asheville were included.

Inoculations with Hypoderma lethale

Dearness *(4)*, who described *Hypoderma lethale* in 1926, wrote that it was severely parasitic to pitch pine in Maryland. However, as Darker *(3)* later pointed out, its pathogenicity had not been experimentally established. In the present study it was found that the ascospores germinate readily on glass slides at high relative humidities, in water drops, and on water, malt, and potato-dextrose agars. The germ tube grows only until it is about as long as the spore and, in trials on several media and in several environments, no mycelium has ever developed. This behavior resembles that of the strictly parasitic fungus *Rhabdocline pseudotsugae* Syd., which causes a needle cast disease of Douglas-fir *(Pseudotsuga menziesii* var. *menziesii*) *(7)*.

Several methods of inoculating pine seedlings were used to test the pathogenicity of *Hypoderma lethale*. The seedlings were one year old at the time they were potted in the fall of 1950. They were inoculated during the summer of 1951, after they had been kept in a greenhouse during the previous winter.

Some seedlings were placed outdoors under an infected pitch pine so that they were exposed to infection under natural conditions. Most of the remainder were inoculated in a greenhouse by placing on and over them pine needles bearing mature fruiting bodies, spraying all with water, and covering them with individual wet muslin covers for an average of 4 days at air temperatures ranging from 60° F. to 90° F.

An attempt was made to provide roughly the same amount of inoculum for each pine within a series. The diseased needles bearing fructifications were soaked in water for about an hour and then examined with a hand lens for fresh mature hysterothecia. Needles with active fruiting bodies were selected and randomized, and an equal number of them were placed upon each pine in such manner that spores would be discharged onto its current needles.

Diseased needles from only one host species were used as a source of inoculum for each series of pines. At least one check seedling of the same species as that from which the inoculum had been obtained was included each time. It was treated like the others except that no diseased needles were placed on it during the exposure period. The pines were kept outdoors following inoculation until cold weather began, when they were moved into an unheated greenhouse for the winter. They were placed outside again in the spring of 1952, after the last frost.

The inoculation experiments are summarized in Table 1. Although the seedlings were exposed to ascospores during the summer of 1951, it was not until January 2, 1952, that small off-color spots indicating infection points were noticed on the 1951 needles. By the end of February biweekly examinations showed that bands of dead tissue were developing on otherwise green needles. Mature *Hypoderma lethale* hysterothecia were found on a few of these needles by June 12. In most cases more than half of the 1951 needles were infected.

Ascospores produced on loblolly pine needles infected pond and slash as well as loblolly pines, ascospores from slash infected pond as well as slash pines, and ascospores from pitch infected pond pine. No infections developed on pitch pine or red pine (*Pinus resinosa* Sol.). Pitch pine is a natural host for *Hypoderma lethale*, but there is no record of the fungus attacking red pine.

Time of Spore Production

It is likely that *Hypoderma lethale* infections occur during the period that the fructifications contain viable ascospores. Spores are

TABLE 1.— INOCULATION OF PINE SEEDLINGS WITH *Hypoderma lethale*, 1951[1]

Inoculum host species	*Inoculation date*	*Inoculation results*				
		Loblolly pine	*Pitch pine*	*Pond pine*	*Red pine*	*Slash pine*
Slash pine	May 31	1/0[2]	1/0	1/0	1/0	1/1
Loblolly pine	June 11	1/1	1/0	1/1	0/0	1/1
Loblolly pine[3]	June 20 — August 29	2/2	0/0	0/0	0/0	0/0
Slash pine[3]	June 20 — August 29	0/0	0/0	0/0	0/0	2/1
Slash pine	June 28	1/0	1/0	1/1	1/0	1/1
Loblolly pine	July 9	1/0	1/0	1/1	1/0	1/0
Pitch pine[4]	July 9 — August 14	3/0	3/0	3/2	3/0	3/0
Pitch pine[4]	August 14 — September 17	0/0	3/0	3/0	3/0	0/0
Pond pine	July 30	1/0	1/0	1/0	1/0	1/0
Loblolly pine	August 1	1/0	1/0	1/0	1/0	1/0
Slash pine	August 14	1/1	1/0	1/0	1/0	1/1
Pond pine	August 21	1/0	1/0	0/0	0/0	1/0
Total number diseased		4	0	5	0	5
Total number inoculated		13	14	13	12	13

[1]None of the check pines became diseased.
[2]The numerator is the number of trees inoculated and the denominator is the number diseased.
[3]Moist covers not used. Diseased needles placed on pines outdoors.
[4]Moist covers not used. Pines placed outdoors under a naturally infected tree.

dispersed when the hysterothecia are moistened sufficiently that they open and expose the spore sacs to the air.

Fructifications collected on the coastal plain of the Carolinas and Georgia in March, April, and early May of 1951 had not yet produced spores. Some of these hysterothecia formed spores in late May and June after they had been placed outdoors in a pine stand at Asheville. Spores were present on attached needles during June and early July.

As an illustration of time of spore production, diseased needles were collected from a slash pine at Brunswick, Georgia, March 21. Ascospores had not yet developed in the hysterothecia. After the needles had been kept uncovered on the floor of a pine stand at Asheville, by May 31 enough spores had been produced to inoculate five pines in the greenhouse, one of which became infected.

Eleven infected loblolly and slash pines near the coast of Georgia and South Carolina were marked in the spring of 1951. When they were inspected October 9, the diseased needles had been shed and no ascospores were found in the hysterothecia. The trees were examined again on June 4, 1952, when mature fruiting bodies containing spores were present on fallen 1951 needles of 5 trees. The attached diseased needles bore only immature hysterothecia.

It was possible to observe the fruiting habits of the fungus more closely at Asheville. Infected pitch and Virginia pines were examined biweekly beginning wth the appearance of needle dieback about mid-April 1951. Ascospores were present in late May, June, and July of 1951, and in June, July, and early August of 1952. Ripe fructifications occurred on both attached and fallen needles. In 1951, some previously unexposed potted pine seedlings of several species were placed under a heavily diseased pitch pine at Asheville from July 9 to August 14. Two pond pines subsequently developed needle blight and *Hypoderma lethale* fruited on their diseased needles the following June. Seedlings similarly exposed from August 14 to September 17 were not infected.

Discussion

Three fungi are often associated with southern pine needles that partially die back. Of these, *Lophodermium pinastri* (Schrad.) Chev. is probably largely saprophytic on dead needle tissue *(1)*. The brown-spot fungus *(Scirrhia acicola)* causes a conspicuous needle blight of large as well as small loblolly pines *(2)* and a major disease of longleaf pine seedlings *(6)*. Much of the needle browning it causes on loblolly pine is noticeable during the fall and winter months.

The third fungus, *Hypoderma lethale*, causes a needle blight that appears in the spring. The writer believes that it is largely responsible for the widespread needle browning that is periodically severe at this time of year over the South on several hard pines not including longleaf.

During the period that the writer has observed needle diseases of southern pines, *Hypoderma lethale* and *Scirrhia acicola* caused most of the needle blights he encountered. It is likely that both of these fungi have been important causes of the so-called needle cast diseases that have been commonly reported in the South.

Direct control of the fungus-induced blights such as Hypoderma blight does not appear to be practicable under forest conditions. It is possible that it may not be necessary. It would seem inadvisable to discriminate against such diseased trees during stand thinnings and salvage cuttings unless evidence becomes available that the growth of infected trees is significantly reduced.

Summary

Observations on needle blights of southern pines from 1949 through 1952 indicate that the fungus *Hypoderma lethale* was an important cause. Trees of many sizes, from seedlings to sawlog trees, developed blight symptoms in the spring. The infective spores of *H. lethale* were found to be produced mostly during June and July. Loblolly, pond, and slash pine seedlings were successfully inoculated by means of ascospores produced on needles. The fungus also was observed in nature on shortleaf, pitch, Virginia, and Table-Mountain pines.

Literature Cited

1. BOYCE, J. S., JR. 1951. *Lophodermium pinastri* and needle browning of southern pines. Jour. Forestry 49:20-24.
2. ———. 1952. A needle blight of loblolly pine caused by the brown-spot fungus. Jour. Forestry 50:686-687.
3. DARKER, G. D. 1932. The Hypodermataceae of conifers. Arnold Arboretum Contrib. 1.
4. DEARNESS, J. 1926. New and noteworthy fungi—IV. Mycologia 18: 236-255.
5. HEDGCOCK, G. G. 1932. Notes on the distribution of some fungi associated with diseases of conifers. U. S. Bur. Plant Indus., Plant Dis. Rptr. 16: 28-42.
6. SIGGERS, P. V. 1944. The brown spot needle blight of pine seedlings. U. S. Dept. Agric. Tech. Bul. 870. 36 p.
7. VAN VLOTEN, H. 1932. *Rhabdocline pseudotsugae* Sydow oorzaak eener ziekte van douglasspar. Proefschrift, Landbouwhoogeschool te Wageningen.

Floristic Analysis of Ground Cover Vegetation by a Rapid Chain Method[1]

S. A. Wilde[2]
Professor of Soils, University of Wisconsin, Madison

SINCE HEINRICH COTTA (*5*), the German forester, introduced floristic classification of forest lands in 1816, ground cover associations have received a great deal of attention by students of forest environment. The voluminous literature published in different languages now includes several thousand reports. Unfortunately, the progress made in building up the theoretical foundations of forest plant sociology has not always been paralleled by the use of available information in silviculture, soil survey, or wildlife management. The failure of technical workers to take advantage of site indices written by Nature herself may be traced to the lack of a simple and rapid procedure for *quantitative* floristic analysis. This paper aims to alleviate this deficiency in a certain measure and reports an adaptation of the line transect method, which was found to possess definite merits in several trials.

Location of tract White & red pine, pa. birch, Gilmore Lake, T39N, R7E, S.14, NW-NE

Forest cover 0.9 Wh.P[6], R.P.[3], P.Bi.[1], 42 years Chain No. 7

Soil type Podzolic sandy loam (Hiawatha series) Direction due W

Species or types of ground cover	Lengths of chain, feet										Tally	Coverage	Frequency
	10	20	30	40	50	60	70	80	90	100	no.	p.ct.	p.ct.
Gaultheria procumbens											30		70
Vaccinium canadense											26		80
Maianthemum canadense											10		50
Pteridium latiusculum											21		100
Waldsteinia fragarioides											39		60
Aster macrophyllum											13		70
Hypnum spp.		4		2		1		2	3			12	50
Chimaphila umbellata											3		30
Corylus americana								7	4			11	20
Aralia nudicaulis											1		10
Streptopus roseus											1		10
White pine seedlings											7		40

FIG. 1.—Standard form for recording the number of plants, the extent of coverage, and frequency of distribution on a 100-foot chain.

Description of the Chain Method

The line transect or "chain analysis" is one of the oldest methods of forest cruising, called "Linientaxierung" by German foresters. The general description of this method is given by Tansley and Chipp (*9*), who stated: "Where time is limited, the line transect alone is very useful, because the charting can be done very quickly, and considerable space sampled in a short time. . . . If the vegetation is really homogenous, the line transect will give much the same information as a quadrat . . ." In a modified form, the line transect method was successfully used by Canfield (*3*) in surveys for range management. According to Bauer (*1*, p. 59): "The transect sampling deserves a much wider use than has been made of it in the past." Buell and Cantlon (*2*) used the transect method for the determination of cover, frequency, and numerical abundance of trees and ground cover plants. These investigators particularly stressed the importance of transect analysis in surveys requiring determination of coverage.

Prior to recording of plants, the area is examined to make reasonably sure that its ecological uniformity is not disrupted by radical differences in composition or density of the forest stand or soil conditions. Following this, a 100-foot steel surveyor's tape, conspicuously marked at 10-foot intervals, is laid out on the ground in a certain direction established by means of a compass. In a country with rolling topography, the direction should be selected in such a way as to cover topographical variations. Then the surveyor walks along the chain and records ground cover plants or tree seedlings whose horizontal projection touches one edge of the chain. If the surveyor does not know the name of certain species, specimens are collected and the plants tentatively recorded as "1x," "2x," etc. In case of consolidated understory of shrubs, blanket of mosses, or grass sod, the total length of plant coverage is determined in feet. The count of plants, or length of their coverage, is registered separately for each 10-foot length. The data are recorded on a special mimeographed form (Fig. 1), carried on a clipboard or in a metal looseleaf binder. It was found advantageous to use a separate recording sheet for each 100-foot chain. The set of completed forms for each study

[1] Paper from the Soils Department, University of Wisconsin. Publication approved by the Director of the Wisconsin Agricultural Experiment Station.

[2] The writer is indebted to Prof. W. S. Cooper, University of Minnesota, and Prof. J. T. Curtis, University of Wisconsin, for their helpful suggestions and criticisms. The assistance in field work and preparation of this report by Drs. G. A. Leisman, University of Minnesota, André Lafond, Quebec Forest Service, and Peitsa Mikola, Finnish Forestry Research Institute, is also gratefully acknowledged.

area is clipped together and filed away for later calculation of different quantitative aspects of the ground cover. The analysis is performed most efficiently by a two man crew, one reading the plants and the other recording them, but it can also be accomplished satisfactorily by one person.

The number of species to be recorded in any particular survey depends upon the nature of ground cover and the purpose of the investigation. In an attempt to reveal the characteristic features of a plant association and establish plant indicators, it would be desirable to record all or most of the species encountered. On the other hand, if this process has already been completed, and the object of survey is to classify land on the basis of selected plant indicators, the recording may be confined to a comparatively small number of selected plants. This would be especially true in appraisal of natural reproduction, estimate of available plant food, and establishment of soil regions influenced by a deep ground water table. In floristic analyses related to soil classification, it would, however, be seldom advisable to record less than ten species, since a definite association of plants rather than a single species usually serves as an indicator of soil composition. On some sites it may be next to impossible to record all the members of the ground cover, and some species will have to be combined into predetermined groups, e.g. grasses, sedges, mosses, and lichens, as suggested by Gates (7).

The total number of chains surveyed and the number of analyzed plots also are varied within wide limits, depending upon the purpose of survey, nature of floristic associations, and size of the area investigated. In all analyses, however, transects are laid out in parallel, and a comparison of the duplicate determinations serves as an approximate measure of the reliability of the results obtained with a given set of transects. The problem of sampling is treated in a later discussion.

Quantitative Aspects of Ground Cover

The generally accepted terms of plant sociology are often ambiguous and confusing to a man familiar with silvicultural terminology. This is especially true of expressions like density, abundance, dominance, and constancy or fidelity. For this reason, the following indices were adopted for the appraisal of ground cover by means of chain analysis: tally, frequency, coverage, presence, and range. The definitions of these terms follow.

Tally.—This term refers to the average number of specimens of certain species encountered per 100-foot chain.[3]

For example, if 64 specimens of *Maianthemum canadense* were encountered in a distance of 400 feet, the average tally would be $64 \div 4$ or 16 plants per 100 feet.

Frequency.—The number of 10-foot lengths in which a species occurs in relation to the total number of 10-foot lengths surveyed, expressed on a percentage basis is referred to as frequency.[4]

For instance, if *Maianthemum canadense* was recorded in 24 ten-foot segments out of 40 segments surveyed, its frequency would be $24 \times 100 \div 40$ or 60 percent.

Coverage.—The percentage of the total length occupied by the consolidated growth of a certain species or a combination of species is its coverage.[5]

For example, if a dense cover of *Corylus americana* occupied 80 feet of the 400 feet surveyed, the coverage would be $80 \times 100 \div 400$ or 20 percent.

Presence.—This term indicates the number of areas of a certain soil-forest unit in which a species is found in relation to the total number of areas of the unit investigated, expressed as percent.[6]

Thus, if *Maianthemum canadense* was found in 9 out of the 12 stands investigated, its presence or probable occurrence would be $9 \div 12 \times 100$ or 75 percent.

A reasonably reliable value for presence can be obtained only by analyzing a sufficient number of individual stands. It was observed that in virgin stands of hemlock and yellow birch on strongly podzolized loams with their uniform ground cover, an estimate of presence may be achieved by analysis of 10 individual areas. In general, however, the establishment of presence requires the survey of a greater number of stands.

For practical purposes it may be desirable to break down the values for presence into several classes, for instance: Persistent—100 percent; Common—70-90 percent; Occasional—40-60 percent; Rare—20-30 percent; Alien—10 percent.

Range.—Range or ecological amplitude, is determined in surveys of broad regions covering a considerable number of soil-forest units. It expresses the degree of adaptation of a species to different soil conditions.[7]

For example if *Sarracenia purpurea* occurred only in black spruce-moss peat type out of 32 soil-forest units surveyed, its range for this particular region would be 1/32. On the other hand, if *Maianthemum canadense* occurred in 17

---

[3] $\text{Tally} = \dfrac{\text{Number of specimens of } X \text{ species recorded}}{\text{Total number of 100-foot chains surveyed}}$

[4] $\text{Frequency} = \dfrac{\text{Number of 10-ft. lengths in which } X \text{ species is present}}{\text{Total number of 10-foot lengths surveyed}} \times 100$

[5] $\text{Coverage} = \dfrac{\text{Length of consolidated cover of } X \text{ species, feet}}{\text{Total length surveyed, feet}} \times 100$

[6] $\text{Presence} = \dfrac{\text{Number of stands in which } X \text{ species was recorded}}{\text{Number of stands analyzed}} \times 100$

[7] $\text{Range} = \dfrac{\text{Number of soil-forest units in which } X \text{ species occurs}}{\text{Number of soil-forest units surveyed}}$

out of these 32 units, its amplitude index would be 17/32.

It is apparent that in attempts to select plant indicators for certain soil-forest types, special consideration should be given to species which show 100 percent presence on this type and, at the same time, have a restricted range of distribution.

An example of the results of the chain analysis is given in Table 1, illustrating the composition of the ground vegetation of non-calcareous sandy podzols in the Hearst region, Ontario (*11*).

TABLE 1.—COMPOSITION OF GROUND COVER VEGETATION OF NON-CALCAREOUS SANDY PODZOLS SUPPORTING MIXED STANDS OF JACK PINE AND BLACK SPRUCE, HEARST REGION, ONTARIO

Species	Tally number	Frequency p.ct	Presence p.ct	Range x/12
Vaccinium myrtilloides	98	59	100	4
Cornus canadensis	86	58	100	7
Maianthemum canadense	76	29	100	6
Linnaea borealis	73	38	71	4
Ledum groenlandicum	57	31	62	7
Epigaea repens	38	17	85	2
Lonicera canadensis	29	13	85	5

NOTE: The dominant mass of the association is made up of *Hypnum* spp. with some Hylocomium, coverage—93 p.ct; in places there occur patches of *Cladonia rangiferina*, coverage 0.3 p.ct.

TABLE 2.—RESULTS OF FLORISTIC ANALYSIS OBTAINED BY AVERAGING THE RECORDINGS ON TWO PAIRS OF ALTERNATE PARALLEL TRANSECTS LAID OUT AT 50-FOOT SPACINGS IN A MATURE ASPEN STAND ON A DEEP-GLEY PODZOLIC SANDY LOAM OF GLACIAL ORIGIN[1]

Species	Average of 1st & 3rd transects		Average of 2nd & 4th transects		Average of four transects	
	Tally	Freq.	Tally	Freq.	Tally	Freq.
Gaultheria procumbens	86	100	78	100	82	100
Pteridium latiusculum	64	100	64	100	64	100
Vaccinium angustifolium	32	67	30	70	31	69
Maianthemum canadense	13	52	11	45	12	48
Lonicera canadensis	31	90	42	100	37	95
Aster macrophyllum	22	60	20	55	21	57
Rubus villosus	19	72	34	92	26	82

[1]The calculation of average values confined to species whose frequency of distribution exceeds 50 percent.

Size of Sample and Accuracy of Transect Analyses

Because of the group production of offsprings, interspecific competition, and formation of adaptive aggregations, ground cover vegetation often consists of contagiously rather than randomly distributed plants (*4, 6*). Population of this kind does not permit application of simple tests of Gaussian statistics for the determination of the required size of the sample, and compels the employment of an empirical approach.

According to observations of Bauer (*1*), a linear transect 900 feet long provides an accurate record of vegetation on an area of about ¼ acre. Bauer made his surveys during four different years under very difficult conditions of chaparral communities, and found that only three man-hours were required for the transect analyses, whereas about 160 man-hours were spent in quadratting the area.

This information suggests that under average conditions a transect sample 800 feet long is likely to furnish reliable information on the composition of ground cover association and indicator significance of different species. This appears to be especially true if plant analysis is performed along four 200 feet long transects laid out in parallel at 50 foot spacing. Such an arrangement covers a sufficiently large sample area and reveals the accuracy of obtained results through a comparison of the average data for number and frequency of different species recorded on two pairs of alternate transects (*10*). Table 2 presents a picture of the variability in the composition of the ground cover vegetation encountered under ecologically homogeneous conditions.

If average results of duplicate analyses show wide variation, additional recordings are required. Table 3 includes the results of chain recordings made by surveys at gradually increased distances from 400 to 1,600 feet. In some instances, the recording of plants at progressively increased total length of transects helps to reveal the concealed differences in the physiographic conditions or previous history of the site.

The careful technique of sampling may be out of place when transect analyses are used to secure approximate information on the distribution of different types of organic soils, density of natural reproduction, supply of game food, and similar data of direct utilitarian value. In such cases the intensity of sampling must approach that of a timber cruiser or a soil surveyor. Parallel transects at 10 chain spacing usually will provide an estimate of a sufficient accuracy for practical purposes. It should never be overlooked that when time is the limiting factor even two 100-foot transects will furnish much more reliable information on the nature of ground cover than ocular estimates. This is true in part because the practice of floristic analysis constantly forces the analyst to broaden his knowledge of plant taxonomy and eliminates appraisals on the basis of familiar species.

Practical Value of Results

The results of quantitative floristic analyses provide objective information on the composition of the characteristic ground cover associations and indicator significance of different species. This information in turn serves as a guide in the survey of forest lands; it helps to establish ecologically important soil units, reduces the number of necessary borings and profile excavations, facilitates the delineation of soil type boundaries, and often reveals the concealed properties of soils, such as erratic in-

TABLE 3.—COMPARISON OF AVERAGE RESULTS OBTAINED IN DUPLICATE RECORDINGS OF THE NUMBER AND SEGMENT FREQUENCY OF GROUND COVER PLANTS BY THE USE OF THE CHAIN ANALYSIS METHOD[1]

Species	Two 100-ft. chains				Four 100-ft. chains				Eighty 100-ft. chains			
	Tally number		Frequency p.ct		Tally number		Frequency p.ct		Tally number		Frequency p.ct	
	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S	E-W
Clintonia borealis	—	0.5	—	5	1.0	0.5	7	5	0.6	0.5	5	5
Lycopodium species	10.5	5.0	15	15	11.0	11.2	42	42	11.0	11.2	34	35
Maianthemum canadense	11.0	11.5	40	60	10.7	3.4	60	40	10.7	10.8	45	40
Trientalis americana	0.5	5.0	5	25	3.2	3.2	40	32	3.2	3.2	40	37
Mitchella repens	2.5	1.0	15	10	3.7	1.0	20	10	2.7	1.1	14	9
Hepatica americana	—	—	—	—	1.0	—	5	—	1.2	1.2	5	5
Streptopus roseus	5.0	1.0	40	10	3.0	2.5	25	10	1.7	1.7	15	12
Galium triflorum	—	1.0	—	10	1.0	1.5	5	15	0.5	0.8	3	7
Waldsteinia fragarioides	10.0	3.0	20	20	5.0	6.0	10	15	2.5	4.2	5	15
Aralia nudicaulis	1.0	—	10	—	0.5	—	5	—	0.3	0.3	3	3
Monotropa uniflora	—	—	—	—	—	0.5	—	5	0.7	0.5	8	5
Dryopteris phegopteris	—	—	—	—	1.0	0.5	10	5	0.7	0.7	7	7

[1]Recordings were made in north-south and east-west directions covering distances of 200, 400, and 800 feet in each direction. Virgin stand of hemlock and yellow birch near Woodruff Fish Hatchery, Oneida County, Wisconsin.

trusions of boulder clay, calcareous substrata, and deep ground water table. In mensuration studies and silvicultural work employing sample plots, results of floristic analyses at times indicate the heterogeneity of the selected study areas in regard to soil properties or past history. In some cases, the composition of ground vegetation is closely correlated with the height growth of forest stands, form of stems, and natural degree of stocking; these relationships may be advantageously exploited in the construction of local yield tables. Under certain conditions, for example, in *Sphagnum* and *Hypnum* swamp forests of Canada, floristic analysis provides at present the only economically feasible method of establishing the potential productivity of the land. Transect analysis may also be used for the determination of the density and distribution of natural reproduction, competing vegetation, and plants subject to eradication, e.g. *Ribes* spp. The use of appropriately modified analysis of the lesser vegetation and components of the understory may serve to evaluate the game cover and supply of game food. Occasionally, the method may supply information on the damages caused by browsing or grazing.

Perhaps the greatest value of floristic analysis rests in the elimination of the subjective and frequently preconceived ocular estimates of ground cover composition, a practice which gave rise to several unjustified generalizations and undermined the faith of foresters in floristic classifications. In some instances, arbitrary classifications converted ground cover vegetation from an extremely useful characteristic of forest stands into a "party line" dogma which substituted a floristic label for the average height of dominant trees. As reported by Lutz and Chandler (8), certain sites are known to have been classified as "Oxalis-Myrtillus" type in spite of the fact that the principal indicator, *Oxalis acetosella*, was not present in a given stand. It is obvious that such a fanatical adherence to a preconceived classificational pattern can be counteracted only by data of quantitative floristic analyses.

Literature Cited

1. BAUER, H. L. 1943. The statistical analysis of chaparral and other plant communities by means of transect samples. Ecology 24:45-60.
2. BUELL, M. F. and J. E. CANTLON. 1950. A study of two communities of the New Jersey pine barrens and a comparison of methods. Ecology 31:567-586.
3. CANFIELD, R. H. 1941. Application of the line-interception method in sampling range vegetation. Jour. Forestry 39:388-394.
4. COLE, L. C. 1946 A theory for analyzing contagiously distributed populations. Ecology 27:329-353.
5. COTTA, H. 1816. Anweisung zum Waldbau. Berlin.
6. CURTIS, J. T. and R. P. MCINTOSH. 1950. The interrelations of certain analytical and synthetic phytosociological characters. Ecology 31:434-455.
7. GATES, F. C. 1949. Field manual of plant ecology. McGraw-Hill, New York.
8. LUTZ, H. J. and R. F. CHANDLER. 1946. Forest soils. Wiley & Sons, New York.
9. TANSLEY, A. G. and T. F. CHIPP. 1926. Aims and methods in study of vegetation. London.
10. WILDE, S. A. and A. L. LEAF. 1953. The relationship between the degree of soil podzolization and composition of ground cover vegetation as determined by a linear transect method. Bul. Ecol. Soc. Am. 34:84.
11. ———, G. K. VOIGT, and R. S. PIERCE. 1954. The relationship of soils and forest growth in the Algoma District of Ontario, Canada. Jour. Soil Sci. 5(1):22-38.

Control And Salvage Policy: Spruce Beetle Control in Colorado[1]

Arthur L. Nelson
U. S. Forest Service
Denver, Colo.

THIS REPORT on the present status of the Colorado Engelmann spruce beetle outbreak is a follow-up on the paper[2] submitted to the Division of Silviculture at the 1949 meeting of the Society at Seattle, Washington. At that time it was the story of an active and very aggressive epidemic of bark beetles moving unmolested and relentlessly through the finest Engelmann spruce stands found anywhere in the country. Control by man at that time seemed impossible.

The year 1939 marked the beginning of what was to develop into the Nation's greatest single recorded bark beetle outbreak. Through 1952 the Engelmann spruce beetle killed an estimated four billion board feet of spruce and a half billion board feet of lodgepole pine. The epidemic was brought under control in 1952. The story of the insects' buildup, life cycle, natural enemies, and other entomological facts have been very thoroughly and capably presented to you by Dr. B. H. Wilford[3] of the Bureau of Entomology and Plant Quarantine so only such references will be made in this paper to the technology of the problem as are necessary for clarity.

The fact that there was an epidemic outbreak of major proportions was first evident in 1942. Local control in timber sale areas by removing attacked trees was the first control practiced. It was soon realized that full information on the life history of the beetle and effective control methods was lacking. Research to obtain these facts was started by the Bureau of Entomology and Plant Quarantine in 1944. With the Nation at that time mobilized on winning a World War and in view of the tremendous rapid buildup of the beetle populations, control work was considered impractical. Even though it was known that the beetle had a two year life cycle and lethal insecticides were well established by 1948, it was decided at that time that the main infested area on the White River National Forest "Flat tops" was too extensive for effective control work by man.

During this time annual surveys and reconnaissance, along with reports by forest rangers on their observations, maintained a fairly accurate picture of the progress of the outbreaks. In 1949, the reports indicated that the beetles had established themselves for the first time across the Colorado River to the southeast and east from the main attacked area on the White River "Flat Tops" 30 miles away.

The question was—should an all out attempt be made to hold the beetle to its then extensive area by fighting it along the outbreaks' perimeter? The remaining stand of the Engelmann spruce in Colorado was directly in the beetles' unobstructed path. The beetle had suffered a very large loss in population numbers in its flight over the wide treeless Colorado River Valley. These points were important and after top level consideration in the Forest Service and Bureau of Entomology and Plant Quarantine, the decision was to go after funds for an all out attempt to control the insect.

The Control Program

1949

With the decision to initiate control work on the Engelmann spruce beetle, it was decided to set up a pilot control project in the fall of 1949 to obtain the operational information necessary to conduct a large project. This pilot-plant project was set up on Basalt Mountain on the White River National Forest in the fall of 1949 and operations were carried on for about a month.

Approximately 3,000 trees were treated and valuable information was obtained on organization, treating methods, and an indication of costs. The project also demonstrated that successful chemical treatment could be accomplished on a project basis.

1950

During the fall of 1949, plans were made for a program of treating an estimated 651,000 trees and a request for a deficiency appropriation of $2,885,000 was submitted by the Department of Agriculture to the Bureau of the Budget. Final appropriation of $2,000,000 was made late in June of 1950.

The 1950 control project, although handicapped by a late start and insufficient funds, accomplished the major part of its planned objective which was to kill the beetle brood in 1949-attacked trees along the eastern and southeastern fronts of the infestation. When the 1950 project closed in October, a total of 784,082 beetle-infested trees had been treated.

The 1950 control project made a tremendous reduction in the beetle population which would have attacked in 1951.

1951

In the fall of 1950 over 2,800,000 gross acres of forest land on the western slope of Colorado were surveyed by the Bureau of Entomology and Plant Quarantine. This survey indicated the need for treating 1,643,000 trees in 1951 on

[1]Paper presented to the Division of Forest Economics and Policy, Society of American Foresters, at Colorado Springs, Colorado, September 14, 1953, as part of the theme: "Economics of spruce bettle control in the Rocky Mountains."

Since the above was written, a new outbreak of the spruce beetle was discovered in the Uncompahgre and San Juan Forests. It is unrelated to the above described infestation. It's of a size that has great potentialities. The survey last fall indicated that approximately 190,000 infested trees should be treated. Control work is planned for this year both by logging and by control crews using the chemical methods developed in the previous outbreak.

[2]Nelson, Arthur L. Beetles kill four billion board feet of Engelmann spruce in Colorado. Jour. Forestry 48: 182-183.

[3]Paper presented to the Division of Forest Economics and Policy, Society of American Foresters, at Colorado Springs, Colorado, September 14, 1953, as part of the theme: "Economics of spruce beetle control in the Rocky Mountains."

51 separate units. Based on this survey data, request was made for $3,895,000 to finance the 1951 control program.

On February 1, 1951, the first real break in the form of control by natural factors occurred. Temperatures reached a record low of minus 56° F. at Eagle and a minus 49° F. at Kremmling. Earlier work by entomologists had determined that sustained temperatures of minus 30° F. beneath the bark was lethal to the bark beetle. It was immediately suspected that some mortality could be expected and it was later proved that the mortality was very high in some areas.

An appropriation of $1,000,000 was made available on August 20 and work started immediately. Actual treating was underway on August 27. Recruitment of labor was difficult because of the late start; a high rate of turn-over was experienced, especially as cold stormy weather arrived in early October. However, 199,502 trees were treated between August 27 and October 20 on which date all camps were closed due to heavy snowfall.

Dr. Wilford has explained the trap tree method of control. During 1951, 2,722 trap trees were felled of which 1,277 were felled by timber sale operators at no cost to the Government. The felled trees were removed from the sale area following the 1952 beetle flight. Those trap trees located in inaccessible locations were treated with insecticide.

Also in 1951, tests were made with ethylene dibromide at a ratio of one part of an emulsifiable concentrate to four parts water. Because only one gallon of this chemical need be transported to treating areas where water is available, considerable savings in transportation and storage costs resulted.

1952

As a result of the "deep freeze" and the increased effect of woodpecker and parasite work combined with effective treating, the beetle population was greatly reduced during the 1951 season. The survey, conducted by the Bureau of Entomology and Plant Quarantine, indicated the probable need for treating 400,000 trees on 18 separate units in 1952 as compared with the estimated 1951 program of 1,643,000 trees needing treatment on 51 work units.

The 1952 project got off to a good start. With a balance of about $200,000 on hand from the 1951 project, and assurance that the requested $1,325,000 would be available in early July, it was possible for the first time to get the project under way as soon as weather permitted.

It became evident early in June that woodpecker work during the winter had been very heavy. A reduced beetle population plus an increased woodpecker population resulted in more effective work by the woodpeckers on the beetle infested trees. Areas on which treating had been planned did not require treatment due to heavy woodpecker work and subsequent drying out of the bark which killed remaining larvae.

As the season progressed, conditions became more and more favorable for bringing the outbreak under control. During August, a marked increase in the effectiveness of parasite work was noted. By the middle of the month it became highly questionable as to whether treating should be continued. The beetle population had evidently been so greatly reduced that parasites and woodpeckers were concentrating on the remaining infested trees. On this basis, it was decided that the natural enemies of the beetle had the situation well in hand and that treating operations could be terminated on the Eagle area on August 16 and on the Kremmling area on August 22.

A total of 232,757 trees were treated with insecticide during the 1952 season. In addition, 2,305 trap trees were cut on the Kremmling area, 1,100 of which were cut by a timber operator and were removed from the area this year. The 1,205 trap trees felled by project crews were treated in the fall of 1952.

Space does not permit going into operating details. The difficulties encountered and surmounted in building access roads, isolated camp construction, equipment procurement, labor problems, storage of large quantities of insecticide, its transportation to the job by truck, jeep, and pack horse are stories in themselves. New techniques and equipment for use in mixing and spraying the tree trunks were developed. The cooperative joint effort by the Forest Service and Bureau of Entomology and Plant Quarantine representatives was an outstanding example in team work. All in all the control work was well planned and efficiently executed.

Although the major job was completed in 1952, there was some maintenance and minor control work needed this year to help the natural enemies get on top of the beetle host. Small epidemic flare-ups may require some control work for a few years longer.

The control work treated a total of 1,219,344 trees during the three years' activity at a cost of $3,327,946. The major threat to the remaining 12.5 billion board feet of Engelmann spruce in Colorado, valued conservatively at $50,000,000, has been wiped out. The insect control policy of immediately controlling insect outbreaks should make it possible to keep the future losses at a minimum.

The control policy of positive and immediate action to control forest insect outbreaks needs little justification other than an analysis of what can happen where such a policy is not followed. The economic loss, including raw material and employment, increased fire hazard and control difficulty, increased runoff with possibility of increased soil erosion, loss of recreational values, are some of the effects of insect outbreaks that such a policy will minimize.

With natural enemies and adverse weather, aided by man's effort, the epidemic has subsided, but in its wake is left a dead forest of 4 billion board feet or more of Engelmann spruce timber. The problem of salvage in the mountain terrain was early recognized as a

difficult one. The killed trees in most cases checked badly and were unfit for sawn products within 2 or 3 years. This pointed to the need for a chemical conversion plant. Possibly a brief resumé of the efforts to salvage the insect-killed timber, similar to that presented this year at the Hearings before the Subcommittee of the Committee on Appropriations, House of Representatives, would be of interest.

The Salvage Program

The infested area was almost completely lacking in roads suitable for timber hauling. The Forest Service proposed the construction of a timber hauling road to tap Cline Top Mesa (north of Newcastle, Colo.) in 1942. This road of 17 miles was constructed in 1943-44. A sale of insect-killed timber for sawlogs was made to the Buckingham Lumber Co. in June 1944. This company cut sawlogs with portable mills in 1944 and 1945. Because of radial checking, sawlogs could not be cut on Cline Top Mesa after 1945.

In 1946 the Forest Service began construction of the Coffee Pot Road (north of Dotsero, Colo.) to tap another major block of insect-killed spruce. This 20-mile road was completed in 1947. Sawlog timber sales were started that year and continued through 1949 when this block also became unmerchantable for sawlogs.

In 1945 the Forest Service started a program to interest Lake States pulpmills in cutting and shipping Colorado insect-killed spruce pulpwood to Wisconsin. Assistant Supervisor Carrol Clark was sent to contact Wisconsin mills for this purpose in the winter of 1945-46. A number of representatives of Lake States mills visited Colorado in 1946 and some small scale trial shipments of pulpwood were made that year. The Consolidated Water Power & Paper Co. of Wisconsin Rapids purchased the remaining timber tributary to the road on Cline Top Mesa (about 30,000 cords) and began cutting in 1947.

In the fall of 1947 the Forest Service increased its efforts to market larger quantities of dead Engelmann spruce to Lake States mills. This culminated in a meeting at Chicago in November, 1947, which was attended by about 100 Lake States pulp executives, railroad traffic men and representatives of the American Paper Association. The Forest Service representatives described operating conditions and the various logging blocks which could be offered for sale.

There was considerable activity and interest in dead pulpwood sales in 1948 but no additional cutting operations were established. Also in 1948 a study was made of the rate of deterioration of insect-killed spruce by the Division of Pathology of the Bureau of Plant Industry. From comparison with similar spruce stands killed before 1920 on high plateaus in south Utah, it was determined that standing insect-killed spruce would remain usable for pulp for many years—at least 20 years and probably more than 30.

In late 1948 the Forest Service was requested by the Columbine Development Co., a newly formed corporation organized primarily by business people in western Colorado, to make an offering of dead timber suitable for the establishment of a newsprint plant in western Colorado. Negotiations with this organization continued through 1949. Bidding on the resulting timber offering of 4,565,000 cords was held on March 29, 1950. Minimum acceptable price was 75 cents per cord, but spirited bidding resulted in a preliminary award to the Columbine Development Co. at $3.10 per cord. Because of emphasis on other type of pulp products during the early phases of the Korean crisis, the Columbine Development Co. shifted its plans to produce other types of pulp. After the company's efforts along this line proved unsuccessful, a renewed effort to establish a newsprint plant of smaller size—around 125 tons daily capacity—was made with participation by Colorado newspaper publishers. A good deal of interest in this proposal developed last summer but the project did not materialize. The Forest Service terminated the preliminary award of the Columbine Development Co. on December 31, 1952.

This timber is now available for resale. There appear to be good justifications to support possibilities of a small-sized newsprint plant which would market perhaps 80 percent of its product in Colorado and vicinity.

Since 1947 the Consolidated Water Power & Paper Co. has continued to produce pulpwood from White River National Forest dead spruce for shipment to Wisconsin. This concern has cut 85,000 cords of dead spruce in the Cline Top and Coffee Pot areas of the White River National Forest since 1947. An additional 60,000 cords were purchased this spring in the Coffee Pot area.

Under the timber sale agreement to which the Columbine Development Co. held preliminary award, the purchaser had the responsibility for construction of necessary hauling roads. Since large blocks of insect-killed timber are available, Forest Service plans have been made on the basis that access roads for further development of the dead spruce areas will be built by timber purchasers.

Including pulpwood, the salvage program to 1953 has removed at least 100,000,000 board feet of insect killed timber. This, admittedly, is a drop in the bucket compared to the four billion board feet available. The Forest Service is ready to sell any volume desired to interested operators. Costs of operating are high compared to most timbered areas, but in face of this there are many opportunities for industry to profitably utilize this timber. We can say that there is some 4 billion feet of dead spruce standing in these mountains. In possibly 20 years this will be lying flat. Certainly here is a challenge to industry and to us as foresters. We hope to find a solution.

Some Implications of the Spruce Beetle Control and Salvage Programs in Colorado[1]

Henry J. Vaux
School of Forestry, University of California, Berkeley, California

THE ECONOMICS of Engelmann spruce beetle control and timber salvage must be considered in terms of the general economy in which the spruce resource exists. Therefore, the discussion which follows is concerned both with the relationship of the spruce resource of Colorado to the economic development of the state, and with what this relationship may mean for the economics of spruce beetle control.

Why protect Colorado spruce from beetles? So far as I can learn, no comprehensive economic analysis of this question has yet been completed, although important segments which I shall touch on later have been studied.

The Engelmann spruce forests have economic value for watershed protection, recreation, and timber utilization. So far as watersheds are concerned, spruce destruction results in (1) some increase in water yields due to reduced transpiration and interception of snowfall (*11*), and (2) an increase in dry fuel accumulation in the devastated stands (*10*, p. 301). If the latter is not offset by more fire protection, serious fires and resulting watershed damages could be expected. The value of the watershed effects of the beetle control program is thus the difference between (*a*) the increase in fire protection expenditures which would have been needed to prevent greater fire losses, and (*b*) the value of the increased runoff which would have occurred in the absence of any insect control.

A technical analysis of the runoff effects of beetle damage in the White River drainage has been made (*11*), but in the available testimony on watershed aspects, I have found no estimates of the net economic watershed gain (or loss) resulting from the beetle control program.

The recreational attractions of the Colorado mountains are unsurpassed. Although the existence of recreational values is obvious, economists have failed almost completely up to this point in providing adequate means for measuring the economic values at stake in recreational use. I suspect that in the case of the threatened spruce stands these values are substantial. But I know of no way of even hazarding a guess as to what they are in quantitative value terms.

Thus, in the case of both watershed and recreation values, economic analysis of spruce beetle control is frustrated by current inadequacies of data and method. These inadequacies present a major challenge to forest economists which we have so far failed to meet. Until we develop methods of analysis suitable for handling these extra-market values, such problems as the economics of spruce beetle control can only be analyzed in part. Major features of such problems cannot be integrated into the cost/returns analysis and must perforce be treated with vague and unsatisfactory generalizations. The fact that the subsequent discussion is largely confined to timber values, even though we are all keenly aware of the economic significance of watersheds and recreation here, reflects this important basic inadequacy of forest economics.

Colorado Timber Resources and Industries

What are the timber values at stake in spruce beetle control? Timber survey work has not been carried on as intensively in Colorado as in some other sections of the country. As a result, there is some conflict in published timber resource statistics (*7*, *2*), and complete inventory details are not yet available. However, the broad dimensions of Colorado forests are clear.

The area of all forest land in Colorado is between 19 and 20 million acres, of which about 8 million acres was classified in 1945 as commercial in character. Seventy percent of the total forest area is in public ownership, and the bulk of this is on national forests.

The Forest Resource Appraisal (*11*) estimated the total volume of commercial sawtimber in the state in 1945 as 27.7 billion board feet. About one-quarter of this volume was considered to be permanently inaccessible, leaving 20 billion board feet as potential economic supply. Ninety percent of the operable timber was in federal ownership. As of 1945, it was estimated that growth exceeded drain by 360 million board feet per year (*2*). Since then, commodity drain has increased and 4 billion feet of timber have been lost to the beetles. As a result, standing timber inventory today is probably a little less than it was in 1945. Over half the total timber volume is Engelmann spruce and an additional 20 percent is lodgepole pine. The beetles have thus threatened three-fourths of the sawtimber in the state and up to 1952, one-fourth of the spruce volume had already been destroyed by them.

Among wood-using industries, lumbering has always been the most important in Colorado. In 1951 it accounted for 86 percent of the volume and 91 percent of the value of timber removed from the national forests. Fifty years ago the state's sawmills were cutting upwards of 100 million board feet of logs per year. Production fell to about two-thirds of this level during the two decades preceding World War II (*6*) but subsequently expanded to 145 million board feet in 1947 (*8*). Since the latter date sampling has been too thin to provide reliable estimates but the available data suggest continued lumber output near the 150 million foot level.

The species "mix" of the state's 1947 lumber production showed Engelmann spruce, 35 percent;

[1]Paper presented to the Division of Forest Economics and Policy, Society of American Foresters, at Colorado Springs, Colorado, September 14, 1953, as part of the theme: "Economics of spruce beetle control in the Rocky Mountains."

lodgepole pine, 24 percent; ponderosa pine, 37 percent; and other species 4 percent (8). Thus spruce, though not the principal wood used by the lumber industry, has provided one of its substantial supporting resources.

The most striking thing about these industry-resource statistics is the comparatively low rate of timber use. According to some published estimates (2), the present surplus of growth over drain is two to three times the present level of cutting. Even a conservative estimate of the technically operable timber volumes indicates that 100 years or more would be required to liquidate the present commercial stand at present rates of use.

As a reflection of this, one finds that current stumpage values are very low, compared with other regions where heavy pressure of timber needs on resources has developed. The average value of Engelmann spruce sawtimber cut from Colorado national forests in fiscal 1951 was $3.23 per M board feet (12). The nationwide average for all national forest timber sales in the same year was $10.20 per M (9, p. 1264). It is apparent that although Colorado stumpage values may have risen somewhat in recent years they have not shared the boom which has brought such inflation to timber prices in most other sections of the country.

A second fact lends emphasis to the situation. Although lumber production here has increased since 1940, the growth has been proportionately much less than in many other areas containing large volumes of untapped virgin timber.

Colorado as a Competitor in Lumber Markets

One explanation for this slower rate of industrial growth is that Colorado is at an economic disadvantage in timber production, compared to competing areas. In support of this view, eighty-five percent of Colorado's lumber-production is used within the state and less than 3 percent of it is marketed beyond immediately bordering states (1). At the same time only about one-half of the lumber used in the state is cut at home. In 1945, mills in Washington, Oregon, Idaho and California marketed as much lumber in Colorado as did the state's own producers. Since then the proportion of lumber shipped from Western Pine Region mills to Colorado destinations has more than doubled (13). These trends suggest pretty clearly that the Colorado lumber industry, despite its relatively more ample raw material inventory, is strictly limited in the extent to which it can compete with West Coast and Idaho supplies, even within the borders of its own state.

Representative logging costs in Colorado appear to range from $25 to $35 per M depending, of course, on the length of haul, difficulty of the chance, and efficiency of the operator. Current logging costs in many areas of the Pacific Northwest and California will average $10 to $15 per M below these figures. In addition, milling costs are higher here and lumber produced is less diversified and contains a smaller percentage of upper grades. The margin provided by lower logging and milling costs is evidently quite sufficient to offset the interregional transportation advantage of the Colorado mills.

Future Spruce Values

Spruce values if competitive disadvantage is permanent.—If one looks no further than this present competitive disadvantage of Colorado spruce, one significant aspect of the economics of beetle control becomes apparent. The general outlines may be seen by comparing the costs of control with an estimate of the present value of the resource, assuming that this competitive disadvantage is permanent.

As there appears to be no technical basis for selective protection of small portions of beetle threatened stands, the value at stake in the spruce beetle epidemic is the total value of the spruce resource in Colorado. So far as timber utilization is concerned, this may be measured by two principal items: (1) the value of the stumpage required to supply dependent wood using industries during the years to come, and (2) the undepreciable capital value of any wood-using plants which would be prematurely forced out of operation by destruction of their raw material supply.

The present magnitude of the spruce industry has already been sketched. Thus, in the absence of some major shift in supply-demand conditions, we might envisage the Colorado spruce industry of the future using about 50 million board feet of timber per year with stumpage values perhaps a little above 1951 levels, say $3.50 per M. If we assume that the spruce areas will be administered and protected anyway, because of their watershed and other non-timber benefits, the stumpage component of value may be determined by applying appropriate capitalization and risk factors to the estimated gross annual stumpage receipts. Using a 2½ percent discount rate and making an allowance of 50 percent of risk free value for the rather high risks which seem to prevail, the present worth of stumpage values would be estimated at about $3½ million

The magnitude of undepreciable plant values depends on the type of sawmill installations, their age, degree of dependence on spruce as raw material, and on the other factors which we cannot here analyze in detail. Due to the characteristic small size of mills, fixed investments are probably rather low. On the basis of average western sawmill conditions, the total investment in sawmilling and logging facilities currently producing spruce could hardly exceed $1 million. A significant part of this investment would be recoverable even if the spruce were destroyed. Thus, the value attributable to beetle control on this account may be of the order of $500,000.

We thus come out with a total value for the spruce timber of about $4 million—a little more than was spent for control. This is admittedly a rather rough and ready appraisal. I wish to use it

only to illustrate the point that, unless Colorado's competitive advantage in timber production is significantly improved in the future by factors we have not yet considered, the timber values at stake and the costs of the program were of roughly equal magnitude. The net benefits of the program would thus be largely confined to the recreational values which have been saved.

Spruce values if competitive disadvantage is temporary.—But there is a second possible interpretation of the economics of the Colorado spruce situation. The comparative disadvantage we have described may be only a temporary condition. Forest industry in Colorado today is an industry with a surplus of timber supply, low stumpage values, small utilization plants, and a concentration on lumbering rather than on diversified wood-using industries. All of these features are characteristic of the frontier stage which has appeared in every major forest region of the United States at some time during the past century (*15*). In the frontier economy, production, incomes, and values, are low compared with other areas, but large undeveloped resources make possible tremendous potential increases in returns if proper measures for economic development are undertaken.

From the standpoint of evaluation of the spruce problem the important question is: "Will Colorado follow the pattern of forestry development which we have seen in other forest regions to the south and west as they emerged from the frontier stage?" As population increases, as industry expands and diversifies, and as the process of economic development runs its course, will the demand for timber raw materials expand dramatically, and thus create an environment which is not now present but which will ultimately bring about widespread timber management on an intensive basis? If so, it would greatly change the comparison of costs and benefits from the beetle control project.

Both growth potentialities and the large reservoir of undeveloped virgin timber indicate that maximum use of Colorado spruce would mean an increase of annual production to perhaps four times present levels of output. Regardless of whether this were achieved by expanded lumber production, development of pulpwood markets, or other means, the effect of such expansion on the value of the spruce asset would be tremendous. It might easily raise these values from the $4 million level of our first estimate to the $60 million figure which has appeared in government testimony on the matter (*9*, p. 956).

A basic question, then, in analyzing the economics of the spruce beetle control program is the one of the likelihood of future economic expansion in Colorado sufficient to develop full use of timber resources.

Economic Development of Spruce

The direction of needed development is toward accumulation of additional capital plant and the diversification of manufactures and trade. The magnitude of the potential development job is tremendous. Garnsey has estimated (*3*, p. 268) that the investment required to develop full use of all available resources in the Mountain West would be of the order of $400 million per year, if the job were to be completed within 20 years. New investment of this magnitude seems highly improbable at present, but the estimate serves as a yardstick to measure the size of the problem faced by Colorado and the other mountain states.

The potential sources of capital for an economic frontier lie, by definition, outside the frontier area. Hence, there must be some economic magnet to attract capital for development purposes. Here forests have often played a strategic role. Much of the basic economic development of the Lake States, the Pacific Northwest, and northern California was accomplished by virtue of the fact that virgin timber, subject to private exploitation, encouraged the flow of private capital into these frontier areas. Economic forces resulted in the liquidation of abundant timber in order to build basic capital plant and to permit the establishment of social institutions which were the pre-conditions for further economic development of these areas. For example, the Pacific Coast traded a large segment of its timber resources for roads, railroads, and organizational facilities, and a further segment for the capital which went into expanded manufacturing and commerce.

Can western Colorado develop its economy through expanded forest use, as other timber-rich economies have done before? Perhaps so, but only if it is recognized that the circumstances controlling forest use here are very different from those under which other forest economies developed. There, the mainspring in the use of forests as a basis for economic growth was the private ownership of virgin timber. Development capital was attracted because of the opportunity to capture the profit from increased land and timber values. Such opportunities are not present to the same extent in Colorado. With the public owning 70 percent of the forest land and nine-tenths of the timber in this state, private capital is less likely to flow into timber development here. Public policies which provided necessary investment stimuli in other forest areas simply do not operate here. There are obvious and compelling reasons against major changes in ownership. Therefore, satisfactory development probably depends on a careful re-examination of all public economic policies to see how investment incentives might best be provided within the existing pattern of resource ownership.

The spruce beetle epidemic, by calling attention to the Western Slope pulp project, has provided both opportunity and necessity for a case study of the obstacles to new investment under the present situation. Professor Ralph Bryant has recently completed a very careful analysis of the economic feasibility of a pulp mill near New-

castle, in the midst of the beetle killed area. I am deeply indebted to Professor Bryant for allowing me to see a copy of his study and for permitting me to quote some of his findings even though they have not yet been published.

Bryant concludes (*1*) that prospective investors would not now regard a 200-ton pulp mill on the Western Slope as "economically feasible" from their viewpoint. However, after a careful weighing of the economic advantages and disadvantages of such an investment he believes that financial assistance from the government might permit economic development of the plant now, and that it may be built at some future date even without such assistance.

Many of the factors which Bryant analyzes illustrate major obstacles to expanded use of the spruce resource. Among these are (1) lack of transportation system, requiring $17 million worth of road construction during the 30-year life of the proposed Western Slope pulp timber sale; (2) need for the Forest Service to consider other interests and groups in the management of national forest lands, possibly at unavoidable expense to the timber utilization operation; (3) unforeseen hazards to the stability of both water and timber supply; and (4) the possibility of pulp and paper pricing systems that would deprive a Colorado firm of its locational advantages in its indicated markets.

A further study of the situation by the Stanford Research Institute (*5*) lends weight to Bryant's conclusions. The Stanford study estimates the investment needed for a 250 ton newsprint mill near Newcastle, at $25.5 million. Such a mill would use 70 to 80 million board feet of spruce per year. This suggests that full development of the spruce resource of the state might require upwards of $50 million of new investment in capital plant alone. Stimulating investments of this magnitude is a large and difficult task.

The Stanford study emphasizes one phase of this problem by comparing estimated costs and returns of a 250 ton newsprint mill at several western locations. Their estimates indicate earnings on the Newcastle investment would be 7 to 8 percent per year before taxes, provided output could be marketed between Salt Lake and eastern Kansas. Such a mill would provide strong cost competition in the four states of Colorado, Wyoming, Utah and New Mexico. Total newsprint purchases of these states in 1951 were almost equal to the output of a mill of 250 ton daily capacity. The basic economic conditions would therefore appear to permit construction, although the rate of return is modest, to say the least.

However, except for Alaska, the other far western sites analyzed in the Stanford study showed significant cost advantages over Colorado for markets in the other seven western states. These had an aggregate 1951 sales volume about eight times as big as the Colorado-Utah-Wyoming-New Mexico market. As a result, prospective earnings at sites in the Olympic Peninsula and the northern Rockies appear to be higher than those at Newcastle. Perhaps equally significant is the Stanford conclusion that a new mill in Arkansas could deliver newsprint to the high volume California markets for $5.50 per ton less than the cost to the Newcastle plant.

The conclusion from these analyses is that such developments as the proposed Newcastle plant are probably feasible but certain disadvantageous features in the regional situation and the possible greater attractiveness of alternative investments elsewhere make a major increase in private investment in Colorado timber utilization facilities unlikely, unless public policies are purposefully designed to achieve this end.

Need for Comprehensive Development Policy

Against this background of economic circumstances and of the critical role of investment capital to effective use of Colorado resources, what sort of an evaluation can be made of the spruce beetle control and salvage program? Two points seem to me worthy of special emphasis because they concern forest policy as it now operates in many areas, not just in Colorado.

First, the situation demonstrates again that the job of forest insect and disease control cannot be appraised adequately on a merely technical level. It must be considered as an integral part of the whole problem of forest development and management. It has been clearly shown in both Idaho and California that the economics of white pine blister rust control depend on the timber management policies which will be implemented in the future. Similarly here in Colorado, the economics of beetle control depend on the policies of timber development which are hereafter pursued. Thus a satisfactory economic evaluation of either spruce beetle control or of other pest control problems would require joint study by land administrators, insect and disease specialists, and economists. The economic interpretation should be made as part of the project planning, not by Monday morning quarterbacks.

Insects and diseases are now recognized as the most destructive enemies of forests. As the scale and cost of pest control measures continue to rise, the need for comprehensive evaluation of each control program becomes more urgent. We will not develop fully satisfactory protection until these cooperative economic analyses are extended across the board, and all potential epidemic situations are weighed on some comparable basis.

As a second conclusion, it seems to me that salvage means more than utilizing four billion board feet of timber before it rots. It means developing use of the entire spruce resource so that the efforts already spent on insect control will yield maximum returns, rather then marginal ones. The immediacy of the salvage problem should be the occasion for scrutinizing a broader range of policies in order to identify the obstacles to eco-

nomic development and to work for their elimination.

For example, is the established competitive bidding process the best way to handle sale of bug-killed spruce, if the prime goal is to develop a new major industry? The "successful" bid on the proposed Western Slope sale was $3.10 per cord—more than four times the minimum appraised price. Whether or not this high stumpage price was a critical factor in the failure of the Columbine Development Company's plans, I do not know. But certainly it was a considerably less attractive investment proposition at $3.10 per cord than it would have been at $0.75 per cord. For the 250 ton mill assumed in the Stanford survey, this stumpage spread represents over one-third of the profit on the entire operation. I suggest that the competitive bidding policy may need modification where large scale industrial development is the primary objective.

A further policy dilemma was illustrated when in 1951 the Columbine Development Company was unable to secure a $15 million loan from the Reconstruction Finance Corporation. The stated grounds for disapproval were that sufficient pulp capacity to meet defense requirements could be obtained without the proposed facilities (*1*, p. 138). There is an obvious conflict of policy where one arm of government is spending $3½ million to protect a resource while simultaneously another arm is denying financing needed to develop the values being protected.

Timber sale arrangements and investment financing are only two of the aspects of forest policy which may influence the course of future growth. Many other circumstances may also be involved. All of these potential obstacles to the flow of capital into the underdeveloped forest areas of the West need more careful study than they have yet received. Unless the investment channels can be cleared of some of the obstructions which seem to have accumulated in them, salvage of beetle killed spruce in Colorado will continue to fall far short of what we might like to see, and many of the potential values at stake in the control program may never materialize. But, far more important, timber resources in this and similar areas will stagnate on the economic frontier. They will not experience the growing intensity of use and management now visible in other forest areas, and they will not contribute fully to the economic welfare of the Mountain West. This, I think, is the most important challenge to forest policy that has arisen from the spruce beetle problem.

Literature Cited

1. BRYANT, RALPH CLEMENT. 1953. The economic feasibility of a permanent pulp and paper industry in central Colorado. A dissertation submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in the Graduate School of Arts and Sciences of Duke University. (Typed.)
2. DEEN, J. L. 1945. The second mile up is forested. American Forests, 51(6): 284-287.
3. GARNSEY, MORRIS E. 1950. America's new frontier: the Mountain West. Alfred A. Knopf. New York. 314 pp.
4. MERRICK, GORDON D. 1947. Distribution of lumber from sawmills in western states, 1945. Division of Forest Economics. U. S. Forest Service, Washington. (Processed.)
5. STANFORD RESEARCH INSTITUTE. 1952. The newsprint situation in the western region of North America. A report to the California Newspaper Publishers Association. Los Angeles. 115 pp.
6. STEER, H. B. 1948. Lumber production in the U. S., 1799-1946. U. S. Dept. Agric. Misc. Pub. No. 669. Washington. (Processed.)
7. TAYLOR, R. F. and E. M. HORNBROOK. 1937. The forest resources of Colorado. A preliminary report of the Rocky Mountain Forest and Range Experiment Station. Ft. Collins, Colo. (Mimeo.)
8. U. S. BUREAU OF CENSUS. 1949. Census of manufactures—1947: lumber and timber basic products. MC24A. Washington.
9. U. S. CONGRESS. HOUSE OF REPRESENTATIVES. 1953. Department of Agriculture Appropriations for 1954. Part 3. Hearing before the subcommittee of the Committee on Appropriation. 83rd Congress, 1st Session. Washington.
10. U. S. CONGRESS. SENATE. 1951. Committee on Appropriations. Agricultural Appropriations for 1952. Hearings before the Subcommittee on HR3973. 82nd Congress, 1st Session. Washington.
11. U. S. FOREST SERVICE. 1953. The watershed aspects of "bug-killed" spruce. Quarterly report: January 1 to March 31, 1953. Report of Division of Forest Influences, Rocky Mountain Forest and Range Experiment Station. Ft. Collins, Colo. April 1. (Mimeo.)
12. U. S. FOREST SERVICE. Engelmann spruce beetle project: some facts about it. Report of Rocky Mountain Region, file S, CONTROL, Insect, Spruce, September 7, 1951. Denver. (Typed.)
13. WESTERN PINE ASSOCIATION. Yearly grades and woods circular. Portland, Oregon. Annually, 1946-1952. (Mimeo.)
14. WOODS, JOHN B. 1946. Report of the forest resource appraisal. American Forestry Assoc. Washington.
15. ZIVNUSKA, JOHN A. 1952. Business cycles, building cycles, and forestry. Institute of Public Administration. New York. 245 p. (Processed.)

Some Silvicultural Problems of the Northern Great Plains[1]

Ernest J. George
Silviculturist, U. S. Department of Agriculture, Northern Great Plains Field Station, Mandan, N. Dak.

In discussing silvicultural problems of the northern Great Plains, it should be made clear that the silvicultural practices of the northern Plains are not for the production of wood for sale, but for the protection against winter winds and drifting snow of farm homes, livestock, wild game, highways, and against damaging hot and strong winds to fruit, vegetable, and other farm crops. The value of trees for these purposes is not expressed on an acre basis, but is measured in reduced fuel costs, increased livestock gains, decreased snow removal costs in farm yards and on highways, increased fruit, vegetable, and other field crops, and the increased comfort to man. Natural tree growth is largely lacking in this area except on some of the more hilly sections that have light to heavy conifer stands and along streams and in ravines that have mixed stands of hardwoods. Deficient precipitation is one of the major limiting factors. In northern Great Plains silviculture it governs every action from making the first plan through the entire life of the stand.

The Northern Great Plains

Area

The area consists of those parts of North and South Dakota west of the 100th meridian and the part of Montana and the northern one-third of Wyoming lying east of the foothills of the Rocky Mountains. The area is approximately 600 miles east and west and about 400 miles north and south. The northern Great Plains area should not be confused with the zone of the Prairie States Forestry Project that received so much publicity while in operation during the middle and late thirties. In that zone, the western boundary of which lies some distance east of the eastern boundary of the Northern Great Plains, trees were grown where the average annual rainfall is 16 to 24 inches while in the northern Great Plains area the average annual rainfall is less than 15 inches.

Climate

The climate is characterized by extremes of temperature in both summer and winter; low average rainfall; frequent droughts; high evaporation rate; and a comparatively short growing season. Temperature extremes vary from -60° F. to 121°, and one North Dakota observer station reported a range of 171° between February and July of the same year. The last killing frost in the spring has been as late as July 6 and the first one in the fall as early as August 7. The growing season averages about 130 days, but has been as short as 49 days and as long as 202 days. Warm-season precipitation—April to September—averages 11.32 inches and annual precipitation 14.84 inches. Annual precipitation has been as low as 3.54 inches and as high as 39.89 inches. Evaporation data from a free water surface are not available for the northern Great Plains as a whole but undoubtedly the values are high. At the Mandan, N. Dak. station, the average growing-season evaporation for the period 1915-52 was 32.99 inches, a little over three times the average precipitation that fell during the same period.

Topography

Topographically the northern Great Plains may be divided into two parts—the glaciated section and the unglaciated one. The glaciated section lies mainly east and north of the Missouri River and is covered with a thick deposit of glacial drift. The topography varies from rough belts of low hills and ridges having many undrained hollows and depressions to well-drained rolling prairie and level stretches of benchland. The unglaciated section is an area of rolling prairie or broad valley having a complete drainage system with several isolated groups of mountains rising abruptly from the prairie. These mountains are covered with heavy stands of coniferous trees.

Soils

The soils of the area fall in the Chestnut, Brown, and Lithosols and shallow soils groups. They range from very fine sand through every texture to clay and shale. Lime may occur in the surface layer and is usually abundant at a depth of 18 to 36 inches. The most adverse soil type for growing trees under dryland conditions is the Pierre series found in western South Dakota and parts of eastern Wyoming. This series includes the so-called "gumbo" soils of the Plains. These soils are extremely sticky and plastic when wet and become very hard and tough when dry; crack badly when dry and absorb moisture very slowly except through the cracks. It is not uncommon for much of the precipitation that falls to be lost through runoff and evaporation.

Kinds of Silvicultural Problems

The northern Great Plains forester has had to develop silvicultural methods peculiar to the Plains country only. His techniques of necessity have to deal with soils and agronomic sciences in addition to forestry. A list of the problems that face him would certainly have to include site, soil type, species, arrangement in the planting, planting stock, size of plantings, spacing distance both in the row and between rows, and management practices.

Investigation of these problems has been carried on by the Bureau of Plant Industry, Soils, and Agricultural Engineering at the Northern Great Plains Field Station, Mandan, N. Dak., and on farms in the northern Great Plains area for a number of years.

[1]Presented before the Division of Silviculture at the annual meeting, Society of American Foresters, Colorado Springs, Colo., September, 1953.

Site and Soil Type

Little can be done about selecting the best site and soil type for growing a farm windbreak. Farm buildings are usually fixed and frequently are located on high land. This may be the poorest site on the farm for trees, which must be planted close to the buildings if they are to serve as protection against wind and snow. Frequently the area near the buildings is in native sod and considerable work is necessary before trees can be planted successfully. The site must be prepared by breaking the sod and working the land into a good state of cultivation before planting. This may take two or sometimes three years. This type of land preparation is also necessary for storing a reserve of water in the soil that will enable the trees to make a good start the first season. A tree planting that does not become well established will never make a satisfactory windbreak. Manure which is recommended and sometimes used for improving the texture of difficult soils and making them more absorbent, is not recommended for trees. Trees planted on land which has been heavily manured or which has been used as a corral or for straw stacks, seldom survive the first summer unless it is very wet.

Species

The Plains forester has more of a problem in selecting species than does the forester planting in natural forested areas. As a result of the testing programs that have been carried on in the Plains states by federal and state agencies, the usable species have been narrowed down from several hundred possible ones to a comparative few. Among these are: Siberian pea-tree (*Caragana arborescens*), Russian olive (*Elaeagnus angustifolia*), tatarian honeysuckle (*Lonicera tatarica*), common and dahurian buckthorns (*Rhamnus cathartica* and *R. davurica*), and western chokecherry (*Prunus virginiana* var. *melanocarpa*) all of which have a shrubby type of growth; green ash (*Fraxinus pennsylvanica* var. *lanceolata*), American elm (*Ulmus americana*), Siberian elm (*Ulmus pumila*), and hackberry (*Celtis occidentalis*), which normally have a tree form of growth but may become shrubby under extremely dry conditions; eastern redcedar (*Juniperus virginiana*), Rocky Mountain juniper (*Juniperus scopulorum*), and ponderosa pine (*Pinus ponderosa*) all have a tree form of growth. On sites that receive supplemental moisture, blue spruce (*Picea pungens*), Black Hills spruce (*Picea glauca* var. *densata*), and certain species of Populus and Salix can well be added to the list. However, even with this small list, the tree planter can err unless he has observed these species in the immediate locality. Certain species respond much more poorly on clay soils than others unless supplemental water is available; some respond very poorly on extremely sandy areas whereas others do very well on such sites; some species thrive on very well-drained sites but die when planted on wet ones or in depressions that collect runoff water.

Arrangement in the Planting

An effective windbreak has the necessary density to trap drifting snow within the planting and sufficient height to reduce wind velocity for some distance on the leeward side. A shrub species should always be planted in the first row on the windward side followed by a taller-growing shrub or tree species in the second row. This order should be followed to the approximate center row of the windbreak when it is reversed and species selected that have a shorter ultimate growth. This arrangement places the tallest-growing trees in the center of the windbreak and prevents any species from being overtopped or shaded on more than one side. Siberian pea-tree has proved to be one of the best shrubs for the outside windward row and redcedar for the outside row on the leeward side. Siberian and American elm usually make the greatest total height growth and are most suitable for the center rows.

Planting Stock

The Plains forester requires planting stock that is suitable for tough planting sites. In order to withstand the severe desiccation that usually takes place the first season, the stock should have a high stem caliper in proportion to its height; in other words the short, sturdy stock grown in thin stands is likely to withstand more drying than the thin spindly stock grown in thick stands. The widespread use of planting machines has somewhat complicated the problem in that the open-grown stock is more branchy and consequently more difficult to handle in the planting machine than is the dense-grown nursery stock. It has not been difficult to obtain good survival with deciduous stock grown according to specifications and planted on properly prepared land.

Survival of conifers has not been as high. Good survival has been obtained only in years when the evaporation rate during the growing season was low. Such seasons occur infrequently on the northern Great Plains. Dipping roots in solutions such as "Transplantone" to stimulate root growth and dipping tops in wax solutions that might reduce the transpiration rate for a few months gave no beneficial results. Conifer nursery stock undercut at the 2-1 stage and shipped out as 2-2 transplants survived better than average stock but did not solve the problem. Growing conifer seedlings in quart oil cans for one or two seasons was practiced to some extent in the late thirties. This method gave a high field survival but presented a transportation problem. The use of tree-planting machines further complicated the problem in that the container had to be small enough to drop in a narrow "V" trench. However, this requirement is proving more favorable in that the small containers can be transported more easily than large ones. Indications are that most conifers planted on the Plains in the future will be potted. Future windbreaks should therefore contain a higher percentage of conifers.

Size of Plantings

Large blocks of prairie land in the northern Plains cannot be successfully planted to trees. On the average upland site, plantings having a large number of rows usually do not succeed for many years owing to the constant and increasing competition for moisture. Drifted snow collected in plantings is the chief moisture supply of trees. Of the average annual precipitation of 14 to 15 inches, a high percentage falls in showers of less than half an inch. An additional 10 to 20 percent usually falls in one or two violent storms of short duration that benefits only the depressions that collect runoff water. If it is possible to collect snow to increase the potential moisture supply on a given area by 100 to 150 percent almost every year or by 400 percent as in some years, then it must be considered good practice to keep the size of the planting down so that all trees might benefit from this additional moisture.

The distance that snow will drift through a belt of trees depends upon exposure of the site to wind, the density of the species in the windward row, and to some extent upon the composition and row spacing of species in intermediate rows. We are all familiar with the highway snow fence consisting of a single row of wood slats with a density of about 40 percent. Only in infrequent years are the snowdrifts more than 75 feet wide on the leeward side of the fence. Snow drifts in windbreaks in a very similar manner. About the first of March each year, a hard-packed snow drift in the trees usually contains an inch of water in each 3 to 5 inches of snow. At that time, snowdrifts 2 to 6 feet deep are not uncommon. While there is loss of moisture by runoff and evaporation from these snowdrifts, there is conclusive evidence that an appreciable amount of water does enter the soil under each drift and that it does directly benefit plant growth. Belts of trees should not exceed 8 to 10 rows in width if all rows of trees are to benefit from the supplemental moisture released from melting snowdrifts.

Spacing Distance

Opinions differ as to the spacing distance for windbreak trees that will give the best chances for survival and protective purposes. In years of normal rainfall, trees a few years of age that receive no supplemental water will exhaust all available moisture in the feeding area, usually by the middle of the growing season. Later summer and fall rains normally replenish only the surface moisture and consequently the trees go into a dormant condition with the soil moisture of the feeding area at the wilting point. Winter precipitation, excluding the moisture that may be derived from drifted snow, is not sufficient to replenish the moisture exhausted the previous season. Replenishment may become less and less each year and eventually the trees start the growing season with little or no stored moisture. They then have to rely on current precipitation.

Trees spaced 15 or 20 feet each way make better crown development during years of plentiful moisture than do the close-spaced ones, 4 or 6 feet on the square. On the other hand, they suffer more injury during drought periods owing to the greater demands for water. Wide-spaced trees offer very little wind protection, and if spaced widely in the row as well as between rows, they are not likely to hold much snow. Distances of 12 to 15 feet between rows and 6 to 8 feet between trees in the row have given indication of being satisfactory for growth and in preventing competition for moisture. Such distances have also been effective in holding wind and snow. Spacings such as 15, 20, or 24 feet each way do not seem satisfactory for dryland planting.

Management Practices

Maintenance of tree plantings on the northern Great Plains is one of the most difficult problems. Trees will be successful only when they are cultivated to control competing weeds, grass, and other foreign growth; fenced to keep livestock out; protected against fire, insects, and diseases. Some of the closer spaced plantings early developed sufficient overhead shade to shut out competitive growth and encourage an accumulation of litter on the floor of the windbreak. Wider spaced windbreaks, such as those having 12 feet or more between rows, have not closed in except in rare instances or with a few species that develop wide-spreading crown growth. Consequently weed control has become a problem in wide-spaced windbreaks. Wind also enters these windbreaks and blows out leaves and other material that might eventually accumulate as a litter. If cultivation to control weed growth is not practiced, the weeds seriously compete with the trees for moisture. Permitting them to grow unchecked has in many instances been directly responsible for the failure of the windbreaks.

Winter Injury

Winter injury is an ever-present problem. Even the old long-time-tested species occasionally kill back severely without any apparent cause. The degree of killing back of the so-called hardy species is probably largely governed by the amount of moisture in the soil in the early fall. While the tree grower usually works toward making all possible soil moisture available to the trees, this practice sometimes works to the disadvantage of the trees. Some species that have an abundance of moisture in September and have not set terminal buds, sometimes either kill to the ground or kill out entirely when subjected to sudden drops in temperature to 10 or 15 degrees below freezing. The same species growing nearby in heavy competition for moisture with weed or other growth suffer little or no injury. Late spring frosts, sometimes occurring in late May cause very severe injury. Much of the so-called winter injury may more accurately be called fall injury. Some progress has been made through the process of natural selection in finding strains that mature earlier in the fall, but there is still a long way to go before every farmer can be assured of

growing a windbreak that will be reasonably free of fall or winter injury.

Reproduction

The Plains forester is seldom troubled with reproduction problems in the planted stands. Reproduction in dry-land plantings is an exception rather than the rule. The question is often asked "Why do not the trees reproduce themselves?" They do, but the reproduction cannot compete with the other growth for moisture and the seedlings soon die. On the Mandan station a number of deciduous and coniferous plantings have a litter several inches thick on the forest floor which provides ideal conditions for germination of seed. Thousands of seedlings emerge in this litter every spring but only a small percentage live through the first year. Occasionally a few seedlings of deciduous trees or shrubs may live longer. If permitted to remain these may eventually form a second story in openings. Irrigated plantings, frequently have dense stands of reproduction of the planted species and of other species the seeds of which have been carried in by birds.

In native stands growing along water courses and in depressions, moisture conditions are favorable enough for the species to perpetuate themselves. Farmers and ranchers remove considerable fence post, fuel, and some sawlog material from these areas. The native stands of trees on the open prairie are usually confined to depressions that have a high water table or collect runoff water. Seedlings emerge at some distances from these groups, but they cannot compete with the native grasses except in wet years. The story is one of tree encroachment on the prairie in wet years and recession in dry years.

Management of the native timbered areas where trees reproduce themselves is hampered by lack of trained personnel. Much of the growth on these areas is of species having little value even for fuel, and until more farm foresters are available, these forested areas are not likely to supplement farm income.

Pruning and Thinning

Pruning of windbreak trees is not recommended. While advantageous in some of the native stands that are used locally for lumber purposes, pruning is more harmful than beneficial in windbreaks. Trees and shrubs that branch from the ground up offer obstructions that reduce wind velocity and diffuse air currents, causing the transported snow to be deposited. Unpruned trees give more shade that prevents excessive competing weed growth and at the same time the shade reduces evaporation from both soil and trees.

Only infrequently is thinning practiced in windbreaks. Nature takes care of weak and suppressed trees by the process of elimination early in the life of the stand. Thinning has been practiced in some places or has taken place by nature through the elimination of entire rows of the less hardy species, as happened in 1934 and 1936. The results suggest that removal of trees having their tops in the main crown cover is the starting point for destruction for the stand. Once the crown cover is opened, trees bordering on the openings sometimes die and the losses may extend back into the stand.

Pests

Control of insects and diseases has not been a serious problem in shelterbelts. Leaf-eaters and borers have been the worst offenders; the former can be controlled by spraying, the latter cannot be controlled by any practical method.

Control of rodents, particularly jack rabbits, has been a serious problem during the early years of stands. During the winter when the prairie and most of the vegetation are covered with snow, jack rabbits travel many miles to a farm windbreak and girdle stems and cut tops. Rabbit-proof fences work satisfactorily until piles of Russian thistles drift against the fence. These piles cause the snow to drift, thus permitting rabbits to pass over the fence tops. Shooting and poisoning are effective if persistently followed. Some repellents are highly effective in preventing injury but it is difficult to get complete stem coverage of bushy trees during cold weather.

Conclusions

The silvicultural problems of the northern Great Plains are many and vary from year to year. The difficulties do not dampen the interest in planting trees in an area where the degree of success is not measured in board-foot volume but in contributing to the building of permanent and more pleasant homes and making possible the performance of farm duties during the winter months.

A Critical Look at Cloud Seeding

Owen P. Cramer
Meteorologist, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon

To reduce the summer fire danger in 1951, cloud seeders were employed by logging companies salvaging snags in the highly inflammable Tillamook burn area of northwest Oregon. Several fixed and mobile silver iodide generators were operated in the vicinity of the burn (8). Rains occurred several times during the summer and early fall, but the question, "Did cloud seeding actually increase the rain?" has never been satisfactorily answered. This question has likewise been debated where clouds have been seeded in other areas.

FIRE-CONTROL MEN want to know if cloud seeding with silver iodide from ground generators is an effective way to increase rain and reduce fire danger. They are naturally reluctant to spend money for extra rain that, by its very nature, is difficult to measure or confirm. This article shows some of the major difficulties that are encountered in appraisals of cloud seeding, reviews critically some of the methods that have been used, and briefly discusses a recommended method of appraisal. The influence of cloud seeding on rainfall is emphasized because fire-control men are most interested in rain. Actually, the same principles apply also to snowfall. Since only general principles are discussed, many details essential to planning an actual test of cloud seeding effects are omitted.

Natural Variation in Rainfall

Natural rainfall in any one locality varies greatly depending on major weather factors that affect rain production. Among the more important factors are age of storm, portion of storm, effect of topography, stability of airmass, and moisture available in the airmass. Young low-pressure storms[1] usually produce much heavier rainfall than older storms which cause rain over much larger areas. Rainfall differs with the part of a low-pressure storm that passes over a given locality. Two similar storms following slightly different routes are likely to produce different amounts of rainfall at the same station. Direction of air flow, as related to major features of relief, affects the pattern of rainfall. Properties of storm airmasses are important. Rains from stable airmasses are characteristically uniform in amount and are little affected by local land relief (*9*). Rains from unstable airmasses are often heavy and erratically distributed and may be strongly affected by relief features. Deep layers of moist air are better rain producers than shallow layers. Summer rains are frequently of the shower type which characteristically misses some localities while deluging others.

Sensitivity of Storms to Seeding

Storms vary also in their sensitivity to seeding with silver iodide. Researchers have demonstrated that direct seeding with silver iodide from an aircraft produces visible changes which differ by cloud type. Some clouds dissipate (*11*) and others markedly change form (*13*). Theoretically, seeding should be more effective in clouds composed of supercooled water droplets than in those that are predominantly ice crystals (*12*). Water droplet clouds at temperatures above freezing are not susceptible to seeding with silver iodide (*10*). The light summer rains over the Oregon Coast Range that originate from low elevation cloud systems entirely at temperatures above freezing cannot, therefore, be modified by seeding from ground generators. Storms in which the air is overturning and mixing will be more greatly affected by seeding from ground generators than will storms in which no overturning and mixing occurs. In storms with no appreciable vertical mixing, one might even question how silver iodide smoke particles could reach an effective altitude. In terms of susceptibility to seeding from ground generators, there are at least three general classes of rain-producing storms: (1) those that cannot be affected by seeding because of above freezing temperatures; (2) those that may be affected in varying amounts; and (3) those that could be affected but are not actually seeded because the silver iodide particles cannot reach the necessary elevation.

Evaluating Cloud-Seeding Operations

Measuring the effect of silver iodide seeding on rainfall poses a difficult statistical problem. This is in part due to the likelihood that the variation resulting from seeding alone may be relatively small and easily obscured by the extreme natural variation that can be expected among rainstorms. Separating the variation due to seeding, from the natural variation, is the real crux of the problem. A given storm might show a positive response (increased rain), a negative response (decreased rain or cloud dissipation), or no response to the seeding treatment.

A parallel example would be a test of the effect of a given fertilizer on a miscellaneous group of garden vegetables. Some vegetables might be retarded by the fertilizer, some might be greatly stimulated, and others might not be affected. The gross effect of the fertilizer, if measured in tons of vegetables per acre, might be very misleading. The result would depend not only upon what vegetables were grown, but also upon the proportion of the acre each occupied. It would also depend upon what was grown on an unfertilized acre for comparison. On the treated acre, equal portions of retarded and stimulated vegeta-

[1]Any weather situation that produces rain will be called a storm even though no violent disturbance occurs.

bles might offset each other to show no effect in terms of total weight produced. Furthermore, if heavy producers predominated on the unfertilized acre, and light producers dominated the treated acre, total weight comparison might be interpreted as showing a negative effect from the fertilizer whereas a positive response might have actually occurred. Here, as for cloud seeding, more sensitive analysis techniques are required.

In the case of the fertilizer test, the first step would be to test each kind of vegetable separately. It is impossible to classify rainstorms into groups as homogeneous and readily recognized as vegetables, but most of them can be sorted into broad groups called storm types (*15*). During rainfall, each storm type has distinctive rain-producing characteristics and weather-map features than can be used to classify it for cloud-seeding studies.

Lack of concrete evidence of the effects of cloud seeding is not due to a lack of analyses of cloud-seeding operations. Many analyses have been made (*1, 2, 3, 4, 5, 6* and *7*), but, as in the fertilizer example, the methods used have usually been unsuited to the job. The three methods most commonly used and their major limitations are as follows:

1. *Observed vs. normal.* — Total rainfall during the seeding operation is compared with normal rainfall for the same period.

Normal rainfall for any given calendar period is an average of all the combinations and frequencies of storm types that have ever occurred in that period. Normal rainfall would actually be observed in relatively few years. Since the frequency of storm types varies from year to year, a comparison of observed and normal rainfall could hardly be expected to reveal the effects of cloud seeding.

2. *Seeded area vs. unseeded area.*—Total rainfall during the seeding period at weather stations within the seeded area is compared with rainfall at stations outside the seeded area. The comparison may be based on only two stations, or broadened to include two groups of stations—one inside and one outside the seeded area. The normal relation between rainfall at the two stations is usually determined by regression analysis (*2* and *5*). The amount expected at the station in the seeded area is then determined through this relation. If the difference between expected and observed rainfall is statistically significant, it is attributed to the seeding.

Rainfall often varies greatly from station to station even within short distances. Natural variation between any two stations is usually too large to permit a reliable measure of the effects of cloud seeding. Furthermore, two stations with the same normal rainfall do not necessarily receive equal rainfall from each storm type. The farther two stations are apart, or the less the similarity in their exposure, the greater is the expected variation for any given period or for different storm types.

A better comparison can be made between groups of stations, one group in the seeded area and one group outside. Even then it is difficult to determine whether the difference between expected and actual rain in the seeded area is due to cloud seeding or to natural variation in the rainfall pattern from a particular sequence of storms. The location of the stations representing the unseeded area in relation to the location of stations in the seeded area may also be important. If the distance is as great as 100 miles, the two areas might receive precipitation from entirely different storms and the results would be meaningless.

3. *Seeded storm vs. unseeded storm.*—Rainfall from a seeded storm is compared with that from a similar unseeded storm. The difference is attributed to cloud seeding.

The seeded storm is first given a type classification. The amount of rain produced is then compared with that from an unseeded storm of the same type. The unseeded storm is usually selected subjectively from past storms of that type. Although the method permits comparison within a group of similar storms, it does not take into account natural variations within the particular storm type. With a small number of tests, the effect of cloud seeding would be obscured by the normal variation within the storm type.

A suggested method.—A fourth method, which has apparently not been widely used but should prove more sensitive, is the comparison of rainfall from a seeded storm with the rainfall in the past from that particular storm type. This method was developed independently of a similar procedure recently suggested by the University of California Statistical Laboratory (*5*).

The method requires several years of rainfall record for the locality or station and a good classification scheme for the storms that bring rain to the locality. Classification should be based on weather map and other storm characteristics existing at the time of rainfall and should group into storm types storms with similar precipitation characteristics. The normal rainfall and expected variation from normal can be computed for each type. The variation can be expressed quantitatively in terms of standard deviation.

If a particular storm is seeded, the resulting rainfall is compared with the average for the same storm type. The difference between the actual and the type average when tested against the standard deviation for the storm type is then used to determine whether the rainfall was usual or unusual. If the observed rain is judged to be unusually high (or unusually low), the inference, of course, is that seeding had an effect.

The following example illustrates the advantage of this method over the use of Method 2, described previously:

During the last 6 days of a 63-day cloud-seeding operation in western Oregon in 1951, heavy rains fell in the target area. Review of the records showed that the occurrence of such a large

amount of rain so early in the fall was indeed unusual. Was cloud seeding responsible? When the storms were classified into types by Woodbridge (*14*), he found that several storms of an uncommon type had passed over the area. For that particular storm type, the heavy rainfall amounts were near normal. A logical conclusion would be that cloud-seeding effects, if any, were too small to detect.

If the effect of cloud seeding on rainfall is slight, a further refinement in methods of evaluation warrants consideration. Two groups of stations with long rainfall records, one group within the seeded area and the other outside but close to the seeded area, are required. The relation between the rainfall in the target area and the check area is then calculated by regression analysis for each storm type. It is thus possible to determine for each seeded storm whether the actual rainfall in the target area differs significantly from the expected quantity based on that in the check area. Repeated significant differences for several seeded storms would provide strong evidence that cloud seeding was effective. Storm types in which rainfall is unmistakably increased will be clearly separated from types where rainfall is either not affected or is decreased.

Summary

Although cloud seeding from ground generators has been used in attempts to increase rainfall and reduce fire danger, its effectiveness has not been proved. Seeding from aircraft has demonstrated that certain types of clouds can be altered by certain materials such as silver iodide "smoke" or dry ice. To demonstrate that indirect cloud seeding from ground generators increases the amount of rainfall is, however, much more difficult. The methods most frequently used in reporting effects of cloud seeding are: (1) Comparison of rainfall during a seeding period with normal for that area and calendar period; (2) comparison of total rainfall in an area subjected to cloud seeding with rainfall during the same period outside the seeded area by regression analysis; and (3) comparison of rainfall from a seeded storm with that from an unseeded storm of similar type occurring at some previous time. All three methods have serious limitations that tend to obscure any effects of cloud seeding. A fourth method, not widely used, should overcome some of these limitations. By this method, the seeded storms are first sorted according to types based on precipitation, weather map and other storm characteristics. Rainfall from a seeded storm is compared with that from previous storms of the same type. Where current observations and past records are available from both target and check areas, this comparison is by regression analysis. A more precise measure of cloud seeding effects is obtained because types most affected by seeding are separated from those least affected, and those that normally produce a highly variable quantity of rainfall are separated from those that produce a more uniform quantity.

Literature Cited

1. BEAUMONT, R. T. 1953. Cloud seeding analysis in Oregon. American Meteorological Society Bul. 34: 298-303.
2. BRIER, GLEN W. and ISADORE ENGER. 1952. An analysis of the results of the 1951 cloud seeding operations in Central Arizona. American Meteorological Society Bul. 33: 208-210.
3. COMMITTEE FOR EVALUATION OF BONNEVILLE POWER ADMINISTRATION CLOUD SEEDING OPERATIONS IN THE UNITED STATES PORTION OF THE PEND OREILLE RIVER BASIN. 1952. Report. Bonneville Power Administration, Portland, Ore.
4. HALL, FERGUSON, T. J. HENDERSON and STUART A. CUNDIFF. 1953. Cloud seeding in the Sierra near Bishop, California. American Meteorological Society Bul. 34: 111-116.
5. JEEVES, T. A., L. M. LECAM, J. NEYMAN and E. L. SCOTT. 1953. On the methodology of evaluating cloud seeding operations. Statistical Laboratory, University of California, Berkeley.
6. KRICK, I. P. and T. B. SMITH. 1952. Some evaluations of sustained cloud seeding operations. Transactions, American Geophysical Union. 33: 1: 53-56.
7. MACCREADY, PAUL B. JR. 1952. Results of cloud seeding in central Arizona, winter 1951. American Meteorological Society Bul. 33: 48-52.
8. NORTH AMERICAN WEATHER CONSULTANTS. 1951. Report on cloud seeding operations in the Tillamook burn during the period August 11 to October 2, 1951. North American Weather Consultants, Pasadena, Calif.
9. PETTERSSEN, SVERRE. 1940. Weather analysis and forecasting. McGraw Hill, N. Y. pp. 40-43.
10. SCHAEFER, VINCENT J. 1951. Snow and its relationship to experimental meteorology. Compendium of Meteorology, American Meteorological Society, Boston, Mass. pp. 221-234.
11. VONNEGUT, BERNARD. 1951. Silver iodide smoke. Project Cirrus, Final Report. General Electric Research Laboratory, Schenectady, N. Y. pp. 27-56.
12. VONNEGUT, BERNARD. 1952. Cloud seeding. Scientific American. 186: 17-21.
13. VONNEGUT, BERNARD and KIAH MAYNARD. 1952. Spray-nozzle type silver iodide smoke generator for airplane use. American Meteorological Society Bul. 33: 420-428.
14. WOODBRIDGE, DAVID D. 1952. A storm analysis of the Tillamook burn cloud seeding operation. Paper presented at national meeting of American Meteorological Society, Corvallis, Ore.
15. WOODBRIDGE, DAVID D. and FRED W. DECKER. 1953. Weather typing applied to summer frontal rains in Oregon. American Meteorological Society Bul. 34: 28-37.

Quail Management on Forested Land[1]

Phil Goodrum and V. H. Reid
Biologists, U. S. Fish and Wildlife Service.

BOBWHITE QUAIL POPULATIONS reached an all-time high during the first quarter of this century. Since the second quarter they have declined in number. During the first quarter practically all of our farming, over most of the bobwhite's range, was done on small farms, which resulted in the large proportion of "edge" which filled the life needs for bobwhite. With the advent of clean farming about 1925, and with the more recent increase in mechanized farming, bobwhite is finding it increasingly difficult to fare well on most farm land.

The tremendous increase in cattle production since World War II, through improved pastures, has also contributed greatly to poor living conditions for quail in the South. This is especially true on farm land and other lands subjected to heavy livestock use.

These changes in our land use are also changing the habits of quail. They are using forested land more and more. As a consequence, more hunting is being done in our woods and forests. Farmers, despite the efforts of professional game managers, have not—and perhaps never will—sacrifice their land, time and money to produce quail; nor can they afford to. Sportsmen have not yet been willing to put up the needed money to induce the farmer to lay aside enough of his land for quail or improve the habitat. Indeed, habitat conditions are getting worse.

Modern farming and modern quail management are seldom practiced on the same piece of land. Where else then, can we practice quail management?

The bobwhite themselves have given us pointers. Since it is a fact that quail hunting is becoming more and more a woods or forest operation, it appears that we must look to forested land for quail production and management.

Southern forests, like farmland, have undergone great changes. The demands of two world wars for forest products have been great. As a result, most of our forests have been cut-over, some of them several times. Since World War II, it has been profitable to practice forestry. A great many landowners, throughout bobwhite's main range, are now growing trees on land that was formerly small farms. Modern methods of forestry are now intensively and extensively practiced, resulting in more forested land.

Although some forestry practices are not beneficial to quail, we find that many bobwhite management techniques can be applied on a large segment of southern forests with little conflict with forest management. In fact, some management techniques such as burning and strip plowing complement forest management and woodland grazing by livestock. Thus, it appears, quail management on forested land offers us a chance to retrieve some of the habitat lost to modern farming and pasture improvement.

On some forest land, of course, quail habitat betterment cannot be practiced without great cost through the loss of timber or the removal of dense stands of scrub hardwoods, nor is quail management practical on forests of all hardwood. Pine forests or a mixture of pine and hardwoods are the best types for management. A large portion of southern forests are of these types. The longleaf pine type (*Pinus palustris*) extending along the Gulf and Atlantic Coasts from Texas to Virginia, including part of Florida, offers great opportunity to combine forestry with quail production. According to Wahlenberg (*6*), the original longleaf pine belt covered from 30 to 60 million acres but now comprises only 15 to 20 million acres. This shrinkage was due to clearing for settlements, farming, and to clean cutting.

The rolling longleaf pine lands support an open-type forest interspersed with springheads, swamps, bay galls, ravines, and small streams, a condition naturally suited to quail. Quail can now be found throughout this type land in varying population densities, depending upon the suitability of local areas for the birds. Good populations, frequently the equal of good farm habitat, exist deep in the forests remote from cultivated land. For example, a pre-hunting season census in 1951 at Eglin Field, Florida, revealed a population density of one bird to 6 acres. This area is normally subjected to light hunting. In south central Louisiana on cutover and forested longleaf pine land, inventories have been made annually since 1947 during the hunting season. The average population density for four years was 1 bird to 20 acres, fluctuating from 1 bird to 10 acres in 1949 to 1 bird to 39 acres in 1947. If a pre-season inventory had been made, the population density would have been higher. Stoddard (*5*) found woodland populations of 1 bird to 4 acres. Figures for farm land habitat are not available for the same general areas as those given above but Goodrum (unpublished data), using 200 men on a drive census in 1937 in Nacogdoches County, Texas, found 1 bird to 6 acres. It is well known that on unmanaged farm land quail populations seldom exceed more than 1 bird to 4 acres.

Quail populations on forest land appear to fluctuate in number from year to year to a greater degree than on farm land. On fair to good farm land habitat, wild foods are supplemented by domestic crops which tend to stabilize the population, whereas, on forested land the birds are dependent entirely on wild foods. For example, it is a well-known fact that longleaf pine, the seed of which is an excellent quail food, produces a heavy seed crop only one year in seven. The oaks and many others also appear to produce good seed crops in cer-

[1]Presented at the Annual Meeting, Southeastern Association, Game and Fish Commissioners, October 22, 1952, Savannah, Ga.

tain years, but little is known about the highs and lows of seed production.

A study of the food habits of 3,053 bobwhites collected on forested land during the fall and winter in south central Louisana over a 5-year period has shown that they feed heavily on tree and shrub mast, especially *Quercus* spp., *Pinus* spp., and redbay (*Persea borbonia*). In years when these species fail to produce normal crops of seed, the quail must depend on a variety of woodland herbaceous plants. Important species are partridge pea (*Chamaecrista* spp.); beggar's lice (*Desmodium* spp.); common lespedeza (*Lespedeza striata*); butterfly pea (*Centrosema* spp.); panic grass (*Panicum* spp.); paspalum (*Paspalum* spp.); goat's rue (*Tephrosia* spp.); milk pea (*Galactia* spp.); nutrush (*Scleria* spp.); and goatweed (*Croton* spp.). The utilization of these plant seeds vary greatly from year to year and from locality to locality. On unmanaged land these species, more often than not, do not provide ample food in late winter.

Good production of wild foods on forested land is determined largely by weather conditions, the cyclic nature of the food plants themselves, and land-use practices such as burning and grazing. Our records shows that heavier seed crops are produced on most of the above species when rainfall is well distributed during the growing season from April to October. There appears to be some exceptions. For example, goatweed (*Croton* spp.) apparently will do well when good rains come during the early growing period, but it can withstand drought in late summer. It is interesting to note that Frye *(1)*, working on heavily cut-over-slash pine *(Pinus elliottii)* land in Florida, found that poor quail crops came when there was excessive rain in summer, which is the reverse of our findings.

In addition to the influence that rainfall seems to have on the plants utilized by quail, our quail population studies indicate that rainfall seemingly influences the percentage of young in the quail population each year. In 1948, there was only 15.6 inches of rainfall during the growing season. Fall and winter wing examinations showed only 59 percent young in the quail population that year. In 1949, there was 30.3 inches of rain during the growing season, and 79 percent young in the quail population that fall and winter. The low production in 1948 was probably caused by a sharp reduction in Vitamin A content of the food consumed during the dry year. Nestler *(3)*, Nestler, Derby, and DeWitt *(4)*, and Lehmann *(2)* have presented data to show that lack of Vitamin A seriously affects reproduction and survival. Furthermore, their investigations have shown that plants growing under drought conditions produce far less Vitamin A than plants grown with sufficient rainfall.

Although rainfall greatly influences quail food production, land-use practices are perhaps of tantamount importance. Our studies indicate that burning, grazing, plowing, planting, timber cutting, and fertilizing all have profound effects on quail and their food plants. Time will not permit a detailed discussion of these land-use practices, but we do know that drought conditions can be mitigated to some extent through habitat manipulation. Our study indicates that burning and plowing helps to reduce heavy grass "roughs" so that good quail plants can thrive. A check for the important forb quail food plants, selected from the quail crop analysis work, on longleaf pine land shows twice as many stems on one-year burn areas as on four-year grass roughs. Two- and three-year grass roughs supported more quail food plants than did the four-year or older roughs. Likewise, plants grown on burned or plowed strips were more vigorous and better seed producers. As would be expected, a greater variety of green food is produced on burned and plowed ground, thus making more Vitamin A available.

Experimental quail management on longleaf pine forest land at the Eglin Air Force Base, Florida, has demonstrated that planted bicolor lespedeza, common lespedeza, and partridge pea will do well under a fairly thick canopy of pine.

Experimental work now being done on the Kisatchie National Forest, Louisiana, indicates that judicious burning and fertilizing can be used to advantage in increasing desirable quail food plants, especially partridge pea, common lespedeza, and beggar's lice.

On farm land, wildlife managers are frequently limited in their application of the above land-use practices in the quail management program. But on forest land, the entire acreage involved can be treated with one or a combination of the above techniques without serious conflict with the primary uses of timber and cattle production. Quail on forest land are mostly found along creeks, springheads, and adjacent lands. They are comparatively scarce on large areas covered with dense stands of grass, especially those areas where woody cover and pine trees are absent, or nearly so. Additional cover and food can be provided in such areas by plowing, and planting bicolor, partridge pea, and common lespedeza in strips at about one-quarter mile intervals. It appears that best quail use of an area can be obtained when such strips lead away from the smaller creeks, bay galls and springheads. Strips planted to common lespedeza can be grazed, thus benefiting quail and cattle. Partridge pea is eaten little by cattle except when heavily fertilized. Cattle must be excluded during the first and possibly the second main growing season of bicolor after which some of the plants will be out of reach of cattle. Cattle, however, can be expected to cut down on seed yield through browsing of the plants. The pine trees themselves furnish food and create good growing conditions for other quail food plants, especially beggar's lice, milk pea, poison oak *(Toxicodendron quercifolia)*, mealy bean *(Strophostyles* spp.), and goat's rue.

Conclusions

Food-habit studies, ecological investigations of quail food plants, quail inventories, and experimental

demonstrations on heavily cut-over and forested longleaf pine land show the practicality and feasibility of quail management on this type of forest land. There appears to be less conflict with quail management and forestry and grazing on forest land than on farm land. With the decline of quail on farm land, it seems certain that we must look to forested land to retrieve reductions in quail populations that have resulted from modern methods of farming.

Literature Cited

1. FRYE, O. E., JR., 1948. Composition and fluctuations of quail populations of Charlotte County, Florida, with particular reference to rainfall. Six pages mimeog. Presented at the Southeastern Wildlife Conference, Lexington, Ky.
2. LEHMANN, V. W., 1952. Vitamin A—Vital element for bobwhites. Texas Game and Fish. 10(6):9-11.
3. NESTLER, RALPH B., 1946. Vitamin A—Vital factor in the survival of bobwhites. Trans., 11th North American Wildlife Conf., pp. 176-195.
4. ———, J. N. DERBY, and J. B. DEWITT, 1949. Vitamin A—Storage in wild quail and its possible significance. Jour. Wildlife Mangt., 13(3):265-266.
5. STODDARD, H. L., 1931. The bobwhite quail. Chas. Scribner's Sons. New York, N. Y.
6. WAHLENBERG, W. G., 1946. Longleaf pine. Chas. Lathrop Pack Forestry Foundation. Washington, D. C.

Forest Research Developments in the Douglas-Fir Region[1]

C. W. Richen
Crown Zellerbach Corporation,
Portland, Oregon

MEN who plan the course of forest management need facts to establish objectives and policies and to direct operations. It will take facts to wisely manage timberlands; to protect them from fire, insects and disease; to conserve soil, water, scenery and recreational values; and to establish, grow and harvest trees with maximum financial return for the long term. It is the task of management to understand the technical, economic, and human factors of the forestry enterprise, and the skill of management will depend on how well the facts are understood.

Research yields facts. Research has been defined as systematic inquiry or investigation into a subject to discover facts or principles. The basic objective of research in forestry is to help foresters solve the many problems of timberland management and operation, and to discover better ways to obtain these solutions. While few will disagree on the objectives of research, there is considerable difference of opinion as to what true forest research really is. Someone has said, "You do research if you plan ahead of time how you are going to go about finding out the facts." This is a good definition for foresters. However, before it is possible to plan ahead of time how to go about finding the facts, it is necessary to define clearly the problem in specific terms so that research can proceed.

The recognition that better forest management requires better facts, that research will yield facts, and that research begins with a clear-cut definition of the problem in specific terms, has created a unique and gratifying development in the Douglas-fir region. The demand for facts to help solve management problems has been so great among foresters in this region that foresters are pooling their knowledge to find the answers. With surprising spontaneity, committees have been formed within the last few years to gather information on a wide variety of problems. The names of these committees show that practically every major forestry problem has received some consideration by these committees. Here are some committee titles:

West Coast Forestry Procedures Committee
Second Growth Management Committee
Forest Soils Committee of the Douglas-fir Region
Rabbit Control Committee
Bear Facts Committee
Seed Testing Committee
Rodent Control Committee
Northwest Seeding and Planting Committee
Nursery Practices and Planting Committee
Forest Industries Nursery Technical Advisory Committee
Forest Management Research Advisory Committee of the Oregon State Board of Forestry
Forest Products Research Advisory Committee of the Oregon Forest Products Laboratory
The Forest Insect and Disease Research Committee and the Douglas-fir Beetle Sub-committee of the Northwest Forest Pest Action Committee
The Forest Advisory Committee of the Institute of Forest Products of Washington
Forest Research Advisory Committee of the Puget Sound District
Research Center of the Pacific Northwest Forest Experiment Station
Forest Credits Committee of the Western Forestry and Conservation Association and its companion committee of The Oregon Bankers Association.

Almost invariably these comittees have been formed to gather facts that are needed by management, to exchange ideas, to specifically define the problem, and to point out those avenues in which additional research is needed to find solutions. The committees have been composed mostly of public and private foresters who have qualified for membership because of their knowledge and their ability to evaluate the problem. It has been encouraging to see the leadership which industry has taken in the sponsorship of many of these committees. This has been a natural development because of the progress of intensive management on industrial forest properties and tree farms.

A good illustration of how this

[1]Paper delivered at the meeting of the Division of Forest Products, S.A.F. annual meeting, Colorado Springs, Colo., Sept., 1953.

is being accomplished, for example, in the field of forest soils work was the organization of the Forest Soils Committee in the final months of 1948. "Since that time, this organization has been the nucleus for forest soils work. It has served in an organizing, educational and publicity capacity in promoting interest in forest soils work. It has also served, and is serving, as a collecting and distributing agent for factual information on forest soils. The Forest Soils Committee, in conjunction with the University of Washington and Oregon State College has sponsored three short courses in forest soils in order to give those foresters who had not had any formal training in soils the opportunity to know some of the basic things about soils. The committee has been instrumental in promoting research and teaching in forest soils at Oregon State College. Because of the interest generated in these past years, and the potential value in forest soils work, the following organizations are now actively engaged in some phase of forest soils research: Crown Zellerbach Corporation; Weyerhaeuser Timber Company; U. S. Forest Service through the Pacific Northwest Forest Experiment Station and Regional Office; Soil Conservation Service; Department of Soils, Oregon State College; College of Forestry and Botany Departments of the University of Washington and Washington State College. The Forest Soils Committee is serving as a coordinating agency for this research by keeping records on research projects and current investigations."

The work of the above named committees has been similar in general to the Forest Soils Committee and have had active industry participation. The committees have had the effect of stimulating interest in forest research by many other organizations beside the old-line research organizations such as the Pacific Northwest Forest Experiment Station, the Bureau of Entomology, and the Division of Forest Pathology. It has brought into focus the needs for research and the opportunity of organizations, both public and private, to make a contribution to forest management in the region.

This work has stimulated the forest industries to contribute to forest management research in several ways:

1. By initiating in many instances active research programs with research personnel of their own.

2. By supporting legislation such as the Oregon State Forest Research Experimental Tax Act, which provides several hundred thousand dollars each year for forest management research and forest products research.

3. By outright grants and scholarships to institutions for use in special research projects.

4. By participation in committee work such as outlined in this paper.

The aggressive attitude of the forest industries towards research has influenced other forest land owners such as farmers, railroads, and others to start looking at their forests with the question, "What shall I do?" Recently a major railroad of the region assigned its forester to the task of direct seeding of some recently logged railroad lands, which resulted in the participation of the forester in the work of the Rodent Control Committee and his ultimate contribution towards knowledge of this problem.

The demands for facts made upon existing research organizations in the Douglas-fir region is so great that other groups must be enlisted in the fact-finding job. It appears reasonable to expect greater participation from the educational institutions, assuming time and money is made available to allow the faculties of the forest schools to do research work. The forest industries, too, can make a greater contribution in the future.

It also appears necessary that foresters in public and private work share in the responsibility for fact finding as they carry out their normal work in the forest. In this regard, Hardy L. Shirley, in the July issue of the JOURNAL OF FORESTRY makes a pertinent comment, "The growing field of employment for foresters greatly widens the opportunity for everyone to share in the intellectual excitement that comes from planning and carrying through a successful research project. By so doing, our profession can move forward rapidly toward meeting the responsibilities that industry, government, and the peoples of other lands are placing before American foresters."[2]

It is the purpose of this paper to point out the development of a *cooperative* approach among public and private foresters to find out the facts which are needed for successful management. Foresters in our region realize that research will yield facts "to replace hunch with certainty, guess with proof, supposition with evidence." This we propose to do.

[2]Shirley, Hardy L. Forest research today. Jour. Forestry 51:483-486.

Some Results from the Chemical Treatment of Trees to Facilitate Bark Removal[1,2]

Hugh Wilcox
Research Foundation, State University of New York College of Forestry, Syracuse, New York[3]

A SERIES OF EXPERIMENTS was begun in the summer of 1951 at the State University of New York, College of Forestry, on the treatment of trees with chemicals to facilitate removal of the bark. Chemical treatment of living trees to achieve bark loosening had been practiced in Canada and the United States for several years prior to the initiation of the research project described here. Much of this work had been empirical and no clear understanding of the mechanism of chemically-induced peeling had been achieved. The purpose of the current investigations at the College of Forestry has been to investigate the important factors influencing the loosening of the bark. Consideration has also been given to the distribution and retention of the chemical in the wood and bark and to problems encountered in forest and wildlife management.

The chemical-debarking research project has now entered its final field season in which it is hoped to arrive at final recommendations for practical chemical treatments. Tentative specifications have been formulated and are being tested widely on company lands on a cooperative basis between the company foresters and the debarking research team. This paper presents some of the information already obtained concerning the basic factors involved in debarking.

Response of Different Species

The effects of the 1952 chemical treatments were observed on 12 species. The number after each species represents its position in a classification of peeling ease determined by an instrument devised by the writer. The results are from mid-season treatments, using a 40 percent sodium arsenite solution on dominant and co-dominant trees, as follows: Hemlock, 17 (very easy to peel); spruce, 25; red oak, 28; elm, 32; balsam fir 32; hard maple, 33; aspen, 35; tulip poplar, 38; red maple, 56; ash, 67; white birch, 90 (very hard to peel). These results were secured in the fall sampling period from October 15 to November 15. Improved peeling results could be expected in the spring after overwintering. This could explain the unusually high peeling class for white birch, a species which has been reported by McIntosh (*1*) and by various companies to respond well to treatment. Ash on the other hand remains a refractory species and has never been found to peel satisfactorily after chemical treatment. The remaining species all appear adapted to satisfactory chemical debarking practices.

Response to Different Chemicals

The chemicals tested for promotion of bark peeling were sodium arsenite, sodium monochloroacetate, chloroacetaldehyde, monoethanolamine arsenite, diethanolamine arsenite, triethanolamine arsenite, isopropylamine arsenite, sodium metasilicate arsenite alkanolamine (amine) salt of 2, 4-dichlorophenoxyacetic acid (2,4-D), the ethyl ester of 2,4-dichlorophenoxyacetic acid, and the isopropyl ester of 2,4,5-trichlorophenoxyacetic acid.

The various experiments with the above chemicals showed that easiest peeling was obtained with the use of the various forms of soluble arsenic. Sodium arsenite is the most advantageous arsenical to use because of its ready availability and low cost.

The 1951 treatments with sodium monochloroacetate used 500 ml. of 2½ and 5 percent solutions in rubber reservoirs around the girdle. The trees treated in this manner were found to peel as readily as those treated with sodium arsenite. The 1952 treatments with sodium monochloroacetate were made by the conventional brush treatment in which a 6 to 8 inch strip of bark was removed from around the tree and the exposed surface of the wood was painted with a 25 percent solution. These brush treatments with sodium monochloroacetate were made on approximately 1,200 trees of several species with very poor results compared to sodium arsenite.

The hormone-type chemicals (2, 4-D and 2, 4, 5-T) were tried at various concentrations in rubber reservoirs. These chemicals were much less effective in killing trees and in promoting debarking than arsenic or sodium monochloroacetate.

Effect of Different Formulations and Concentrations of Arsenic

During the 1951 season, studies were made of the effects of variations in concentration of sodium arsenite, of variations in the sodium hydroxide concentration in arsenite formulations, and of the addition of wetting agents to the arsenite solution.

A commercial 40 percent soduim arsenite solution in 1:0 and 1:1 dilutions (20 percent) with water was an extremely effective debarking agent for brush treatments.

[1]Paper delivered at the joint meeting of the Divisions of Private Forestry and Forest Products, 53rd anual meeting, S.A.F., Colorado Springs, Colo., Sept., 1953.

[2]This work is sponsored by the Chemical Debarking Project, which is composed of the following companies: American Smelting and Refining Company, Brown Company, Eastern Corporation, Eastern Pulpwood Company, P. H. Glatfelter Company, Hollingsworth and Whitney Company, International Paper Company, Oxford Paper Company, West Virginia Pulp and Paper Company, Marathon Corporation, Penobscot Development Company, Fraser Companies Limited, St. Regis Paper Company, and Dead River Company.

[3]The members of the Chemical Debarking Research team at Syracuse are Dr. Hugh Wilcox, Project Leader, Dr. Felix Czabator, Dr. Robert Smith, Dr. Guido Girolami, Dr. Donald Moreland, and Margaret Grisdale. Dr. Merritt McGahan was a member of the team during the first year. Dr. William Webb, Associate Professor, and his students Edwin Rosasco and Stephen Simkins carried out the wildlife phases of this study. Karsten Mathisen, graduate student, analyzed pulps for arsenic content.

Sodium arsenite was somewhat less effective in a 1:4 dilution (8 percent) and very erratic in a 1:9 dilution (4 percent).

The effectiveness of the sodium arsenite as a killing agent was not appreciably decreased by changing the alkali content. However, the peeling resistances were somewhat increased by an increase in the quantity of sodium hydroxide.

The addition of wetting agents and stickers in the 1951 tests seemed to result in a somewhat better peeling of some species. Because of this improvement in peeling results, additional tests were performed in 1952. A stock of 62 wetting agents and stickers was secured and tests were conducted to determine whether these products were completely compatible with sodium arsenite (and with sodium monochloroacetate). The wetting agents were screened for compatibility, wetting action, and for penetration through leaves according to the test reported by King (2). The most effective of these for use with sodium arsenite was found to be "Ethomeen S-25."

The stickers were also tested for compatibility and for spreading qualities. "Indulin A" was selected for use with arsenite solutions.

These 1952 treatments with wetting agents and stickers added to the treating chemicals were performed on a total of 4,090 trees of 15 species. An analysis of the data from these treatments indicated that the additives did not significantly improve the peeling secured from the treating chemical. On the basis of these results, it appears safe to conclude that the addition of stickers or wetting agents to sodium arsenite does not improve its debarking properties.

Effect of Different Types of Girdles

The following types of girdles were investigated for their effect on speed of kill and debarking action: (1) A bark strip removed around the tree (bark girdle) with treatment made using a rubber reservoir around the girdle; (2) a bark strip removed and a notch made into the sapwood (sapwood girdle) with reservoir treatment; (3) a bark girdle with the exposed sapwood surface painted with the debarking solution by means of a paint brush; (4) a sapwood girdle followed by paint-brush treatment; (5) a frill made into the tree by overlapping axe cuts around the circumference of the tree with the chemical poured into the frill.

The reservoir treatments were performed in order to control the amount of chemical in conjunction with the collection of samples for anatomical and biochemical analyses. The effectiveness of any of the treating chemicals in killing was increased by a sapwood cut. Reservoir treatments were also made in which the treating chemical was allowed to come in contact only with the cut edge of the bark either above or below the girdle. These bark treatments did not result in killing and the arsenic remained unabsorbed for over two months.

Sodium arsenite treatments were also applied to the scored bark of yellow birch and red spruce and were found to be ineffective.

Experiments were also performed with "interceptor" girdles above the treating girdles. Such girdles did not prevent killing from arsenic applied to the lower girdle even when the upper girdle was notched over $\frac{1}{2}$ inch into the sapwood.

The frill treatments were tried on red spruce, red maple, white birch, and aspen with sodium arsenite, sodium monochloroacetate, and chloroacetaldehyde. These treatments were not as effective in producing peeling as the commercial-type paint-brush treatment applied to a band girdle.

The band type of girdle with the paint brush application of sodium arsenite was found to be effective in producing a quick kill and effective bark removal for most species. There was no significant difference in peeling results between scored and unscored sapwood at any season. Some of the anomalous results obtained by various workers using the brush technique may be accounted for by the failure to apply sufficient chemical to the girdle. The chemical should be applied liberally, preferably two or three applications of the chemical being made to the girdle at the time of treatment. It appears that the minimum girdle width for trees 8 to 10 inches in diameter should be 6 inches, and for larger trees this width should be increased. Further tests are in progress during the 1953 season to check the effect of girdle size relative to the various diameter classes.

Effect of Time of Treatment

Chemical treatments in 1952 were made throughout the period from April 1 to September 1. Treatments performed during the sap-peeling season definitely gave the best peeling results. The sap-peeling season for the hardwoods begins after the middle of May and ends by the first week in August. The season is a few days longer for spruce.

Distribution of Arsenic After Treatment

Arsenic analyses of the 1951 reservoir treatments were made several weeks after treatment to obtain information on the vertical distribution of arsenic in spruce and birch after death had occurred. The concentrations found were naturally much higher than those occurring following the commercial-type brush treatment because the girdles were bathed in arsenite solutions for extended periods of time. These analyses showed that the arsenic content of the bark near the girdle averaged 3 to 4 times that of the wood immediately adjacent to the bark. The greatest accumulation of arsenic occurred near the girdle with the concentration diminishing rapidly with elevation in the tree. For example, one red spruce analyzed 1 month after treatment had 7,600 p.p.m. above the reservoir but 300 to 400 inches up the tree the concentration of arsenic in the wood was only 10 to 20 p.p.m. although the tree peeled all the way to the top. The concentration was always greater in the bark than in the wood. Two foliage samples anal-

yzed contained 6 p.p.m. in yellow birch leaves and 61 p.p.m. in red spruce.

In contrast to the high arsenic contents in the reservoir treatments, arsenic analyses made of the wood from the surfaces of the girdles of yellow birch and red spruce in the spring of the year following brush treatment showed 187 p.p.m. for a yellow birch and 6 p.p.m. for a red spruce.

Arsenic analyses were also made of 1952 treatments made with reservoirs and with brush treatments. Treatments were made both with and without cuts into the sapwood. The wood of trees with scored sapwood contained a higher concentration of arsenic than comparable trees with unscored sapwood. This extreme accumulation of arsenic extended to a depth as great or greater than the depth of the cut. Half an inch in from the cambium there was occasionally a greater concentration of arsenic than at the surface. When the sapwood was not scored the arsenic was confined to the surface to a surprising degree, and in some instances was entirely restricted to the outer part of the last annual ring.

Arsenic Content of Pulp

Analyses were made on wood chips from mixed hardwoods that had been chemically peeled as well as on the acid and alkaline pulps made from the wood. The content of arsenic was found to be uniformly low, from 0 to 2 p.p.m. Equally minor amounts were found to occur in chips and in pulps from untreated wood. These values are within the tolerance allowed for arsenic on food (the U. S. Food and Drug Administration allows 3.5 p.p.m. of arsenic trioxide on fruits and vegetables).

Translocation of Sodium Arsenite

The movement of arsenic away from the girdle face in the commercial-type paint-brush operation was studied with radioactive arsenic. These studies were started late in the 1952 season and are being continued during the 1953 sap-peeling season.

The results from the post sap-peeling season showed that arsenic moved away from the girdle very rapidly when the sapwood surface was unscored. Less than 5 percent of the applied arsenic remained after 48 hours in red spruce and after 72 hours in yellow birch. In the scored trees the depletion of arsenic occurred gradually and slowly, the reduced movement probably due to an interference with the normal channels of transport.

Anatomical Studies

Studies have been made throughout the duration of the project on the anatomical features of natural and of chemically-induced peeling. Some of the problems investigated to date include the principal features of the normal developmental pattern of the cambium, phloem, and xylem of red spruce, white spruce, and yellow birch; the variation with season of the time after treatment required to induce anatomical modifications; the time at which maximum expression of chemical action occurs; the comparative effects of sodium arsenite and sodium monochloroacetate on spruce and birch; postmortal changes following sodium arsenite and sodium monochloroacetate treatments and their correlation with peeling resistance; and comparative effects of chemical treatment relative to the degree of activity of the vascular cambium.

The information obtained on the normal ontogeny of the cambium and derivative tissues of these species is so extensive that it will be reported in detail in another paper. A brief resume will be given here.

Studies of the natural peeling showed that the start of peeling occurs rather suddenly, preceding cambial divisions by approximately a month. Once initiated, however, cambial activity aids materially in bark removal. The early bark slippage is apparently due to a hormone mechanism which is associated with early phloem reactivation and is in operation prior to the initiation of cambial activity.

Studies of chemically-treated trees showed that during the pre-sap-peeling period no anatomical modifications were evident in either sodium arsenite or sodium monochloroacetate treatments. During the sap-peeling season, however, both chemicals were found to induce very drastic alterations in the internal architecture of the trees. Cells of the cambium and newly-formed xylem underwent extensive collapse. Immature phloem cells were also seen in a state of partial collapse and the sieve elements showed an excessive deposition of callus, a sign of decreased function. The release of tannins and phlobaphene compounds from the dying phloem ray cells and phloem parenchyma resulted in an extreme browning of the bark tissue. The responses of yellow birch and red spruce were for all practical purposes identical. During the early part of the post-season treatments the response of the two species was similar to that exhibited during the mid-season, but of a lesser magnitude.

The samples from which the above observations were made were taken 18 inches above the point of treatment. At this sampling point, the action of the two chemicals was identical. However, later observations showed that only the arsenic was of sufficient toxicity to promote peeling throughout the length of the trees.

Wildlife Studies

In 1951 and 1952 studies were initiated at the Huntington Wildlife Forest relative to the effects on wildlife of sodium arsenite used in chemical debarking of trees. Results of the two years' study indicate that possibly chemical debarking will increase animal populations from improved food supplies due to opening the forest stands. Careful study shows that losses of wildlife by proper chemical debarking technique are negligible. The actual danger period following treatment is very short. Tests are being made during the current season of the effect of repellents added to the debarking solutions to further lessen the danger to wildlife.

Conclusions

A great deal of practical and fundamental information has been obtained from the two years of study on chemical debarking described above. Many of these results are being subjected to further testing during the 1953 season. It is expected that improved specifications will be formulated for commercial treatments so that it will be possible to carry out large scale operations with good success.

Literature Cited

1. MCINTOSH, D. C. 1951. The effects of chemical treatment of pulpwood trees. Canada Department of Resources and Development Bulletin 100. Ottawa.

2. KING, LAWRENCE J. 1948. A leaf immersion technique for studying the absorption and translocation of chemicals in plants. Contributions from the Boyce Thompson Institute 15(3): 165-171.

Cedric H. Guise Retires

Cedric H. Guise, director of the 4,000-acre Arnot Forest since its acquisition in 1927, retired from the faculty of Cornell University on July 1.

Prof. Guise is co-author of *Forest Education* published in 1932, which led to nation-wide improvement in forestry schools. Under the sponsorship of Society of American Foresters, he surveyed forestry training programs throughout the United States and Europe with the late Henry S. Graves, dean of the Yale School of Forestry.

Born in Findlay, Ohio, Prof. Guise received a B. S. degree in 1914 and an M. S. in forestry in 1915, both from Cornell. He began as an instructor in forestry in 1915, and was named assistant professor in 1921 and full professor in 1933. He spent his entire professional career at Cornell, except for brief leaves of absence.

CEDRIC H. GUISE

On one of these in 1917-1918, he served in the U. S. Signal Corps; on another in 1929-31, he worked on the S.A.F. forestry education study. During 1937-1944, he was a member of the administrative staff of the College of Agriculture.

He has taught courses in farm forestry, forestry management, and natural resource conservation, and is the author of a widely used text in farm forestry, *The Management of Farm Woodlands*, co-author of *Forest Management* and *Conservation in the United States*, and has published many articles in the forestry journals.

He is a Fellow of the Society of American Foresters and of the American Association for the Advancement of Science, and a member of the advisory committee on forestry of the Oberlaender Trust for the Carl Schurz Memorial Foundation.

During 1945-1950, he was a member of the advisory committee on forestry to the state government, and assisted in drafting the New York State Forest Practices Act.

Notes

Tree Climbing Safety Hint

Foresters at the Lake City Research Center found a safety problem when climbing trees with the so-called "Swedish ladder." At times the chain, which fastens each section of this ladder to the tree, tends to slip out of its lock hook.

To overcome this problem, a moderately stiff coil spring (0.105-$^{3}/_{4}$-2") was inserted between the "U" bolt on the side of the ladder section and one end of the chain. This spring makes it possible to keep the chain under tension by pulling the correct link into the lock hook. The tree may sway in the wind, bark may flake off under the chain, or the weight of the climber may shift the ladder, but the spring will take up any resulting slack in the chain.

The "Swedish ladder" is an essential piece of equipment in the Forest Tree Improvement Program at Lake City, Florida. It is used in all phases of controlled breeding as well as for the collection of cones and scions selected pines. During the breeding season each tree has to be climbed several times, and this calls for a rapid and safe method to reach the crown.

As the name indicates, the ladder was designed in Sweden for the purpose of climbing outstanding trees of great height and bare stem. It is made of lightweight aluminum and comes in 3-meter sections, which can be fitted together by simple slot connections. one side of each section a slender chain is fastened. The section is secured to the tree by pulling the chain tightly around the stem and pushing the nearest link into the lock hook on the other side of the

FIG. 1.—Setting up the "Swedish ladder" in slash pine stand, especially cut for seed production. The bottom section is being secured by pulling the chain. Pushing the correct link into the lockhook is facilitated by the spring which was added (insert).

FIG. 2.—The fourth section is being placed. A dangling rope is used to haul up additional sections.

ladder. The safety problem arose from the fact that, as it is designed by the factory, the chain cannot be stretched, and consequently can slip out of its lock hook with alarming ease. Adding a spring as described previously, eliminates this safety hazard.

The climber generally fits the two bottom sections together on the ground and tightens the chains as he goes up. A lineman's belt enables him to use both hands in hauling up, placing, and securing as many more sections as are needed to reach the live crown. In this manner it takes from 5 to 10 minutes to climb 50 or 60 feet of bare stem.

E. E. MILES
and P. E. HOEKSTRA
Southeastern Forest Expt. Sta., Lake City Research Center, Lake City, Fla.

A Uniform Service Test For Fence Posts[1]

Service-testing fence posts in plots or regular fence lines is a common method of evaluating wood preservatives. At regular intervals the posts are inspected for indications of attack by insects and fungi. During these inspections, most investigators stress the test posts as a cantilever beam as a means of determining whether the post is serviceable. Graham (*3*), and others, apply a 50-pound load by means of a spring balance at a specified height above ground, whereas Blew (*1*) prefers to give each post "a moderate push" at the top. The author has used both techniques in tests under way at the Illinois Agricultural Experiment Station.

By either method (push or measured pull), each loading tends to accelerate the failure of the test specimen. A post that does not fail under the test load is weakened as a result of a stress which loads it beyond the proportional limit. Although accelerated testing may be desirable, the same rate of acceleration should be applied to all test specimens.

Obviously, two posts treated to the same degree of protection may serve different lengths of time because of size differences. Untreated eastern white pine posts, for example, have served from 2 to 10 years in Illinois tests; the wide range in service life is believed to be mainly the result of cross-sectional size. Since there is usually a range in the diameters of the test posts, it is obvious that a uniform load applied to all posts does not stress them the same amount at the ground line and a moderate push cannot be considered a uniform test.

One method by which the test can be applied more uniformly is to apply whatever load is required to give a "standard" stress in the outermost fiber at the ground line. This load can be determined by means of the flexure formula[2]

$$S = \frac{Mc}{I}, \quad I = \frac{\pi r^4}{4}$$

and to use the "standard" stress to calculate the loads. For example, a post 6 inches in diameter set so that the above-ground length (moment arm) is 3.5 feet is loaded with a 50-pound pull:

$$S = \frac{(50)(3.5 \times 12)(6/2)}{(3.1416)(3^4)/4} = \frac{6300}{63.6} = 99 \text{ p.s.i.}$$

where S, the stress in the outermost fiber at ground line in pounds per square inch

M, the bending moment at ground line

c, one-half depth of post; this is same as one-half the post diameter

I, the moment of inertia of ground-line section, inches[4]

r, the post radius, inches.

Thus, if the "standard" stress in the outermost fiber at the ground line is set at 100 pounds per square inch, we can solve for the loads required to produce this stress in posts of other diameters. Table 1 shows the loads required to produce the 100-pound stress in posts of different diameters and above-ground lengths.

It may be noted in the table that whereas 50 pounds are required to produce the "standard" stress in a 6-inch post set 3.5 feet above the ground, a load of less than 2 pounds is required to produce a stress of the same magnitude in a 2-inch post.

TABLE 1.—LOADS IN POUNDS REQUIRED TO PRODUCE 100-POUND STRESS IN POSTS OF DIFFERENT DIAMETERS AND ABOVE-GROUND LENGTHS

Post ground-line diameter, inches	Post height above ground, feet[1]		
	3.0	3.5	4.0
2.0	2.2	1.9	1.6
2.5	4.3	3.7	3.2
3.0	7.4	6.3	5.5
3.5	11.7	10.0	8.8
4.0	17.5	15.0	12.8
4.5	24.8	21.3	18.6
5.0	34.1	29.2	25.6
5.5	45.4	38.9	34.0
6.0	58.9	50.5	44.2

[1]Loading point.

Literature Cited

1. BLEW, J. O. 1948. Service tests on posts as a means of evaluating wood preservatives and methods of treatment. Report No. D1726, U. S. For. Prod. Lab., Madison, Wisc.
2. BROWN, H. P., A. J. PANSHIN, and C. C. FORSAITH. 1952. Textbook of Wood Technology. Vol. II. McGraw-Hill Book Co., Inc., New York.
3. GRAHAM, ROBERT D. 1950. Service life of treated and untreated fence posts (Project No. 29). Progress Report 4. Oregon Forest Prod. Lab., Corvallis.
4. WANGAARD, F. F. 1950. The mechanical properties of wood. John Wiley and Sons, Inc., New York.

C. S. WALTERS
Assoc. Prof. of Forest Utilization Research, Illinois Agric. Expt. Sta., Urbana

[1]The author is grateful to Professor W. A. Oliver, University of Illinois Department of Civil Engineering, for reviewing this report.

[2]For further information on timber mechanics, see references (*2*) and (*4*).

A Naturally Occurring Aspen-Poplar Hybrid

During 1952, in the course of a search for natural stands of bigtooth aspen (*Populus grandidentata* Michx.), the authors found a 1-acre stand with trees whose leaf and bud characteristics differed markedly from the typical bigtooth. A possible hybrid between European white poplar (*Populus alba* L.) and bigtooth aspen was suspected.

Leaf and twig specimens collected from these trees were sent to Dr. Scott S. Pauley, lecturer in forest genetics, Harvard University, for suggestions regarding their identity. After comparing our specimens with hybrids produced by controlled pollination, Dr. Pauley reports that these trees are undoubtedly hybrids of *Populus alba* and *Populus grandidentata*, two species which hybridize freely and easily.

Recently this hybrid stand which is located in the NE¼, NW¼, Sec. 36, T68N, R8W, Van Buren County, Iowa, was studied in greater detail. The trees are apparently members of one or, at most, several clones and were established as root suckers from one or several original seedlings. They are growing on Lindley loam soil on a 28-percent slope. The aspect of the stand area is west but the plot is on the lower one-third of a sloping ridge having a north exposure.

These hybrid trees appear to have the superior form and growth habit of bigtooth aspen and the rapid growth rate of white poplar (Fig. 1). The average stand age is 24 years. The largest tree, occurring on the west edge of the stand, is 11 inches d.b.h. and about 85 feet high. The main stand is overstocked and competition has resulted in high mortality.

Stand and stock data taken from a tenth-acre sample plot in the center of the dense stand are given in Table 1. On an acre basis there are over 800 trees ranging from 3 to 9 inches d.b.h. and from 34 to 74 feet in height. There are over 3,500 cubic feet of wood per acre. This represents a mean annual

TABLE 1.—STAND AND STOCK TABLE FOR ASPEN-POPLAR HYBRID

D.b.h.	Trees	Basal area	Total height	Total volume[1]	Merchantable volume		Posts[3]
					Unpeeled[1] 3″ top i.b.	Unpeeled[2] 4″ top i.b.	
Inches	*Number*	*Sq. ft.*	*Feet*	*Cu. ft.*	*Cu. ft.*	*Cords*	*Number*
3	140	7.84	34	127.68	0.0	0.00	0
4	160	14.72	42	312.48	171.2	0.00	320
5	170	24.14	51	550.80	239.7	3.23	680
6	240	48.72	61	1,328.16	1,183.2	13.92	1,200
7	70	19.25	69	584.22	547.4	6.72	350
8	50	17.45	73	561.40	531.5	6.75	350
9	10	4.03	74	131.68	125.0	1.64	70
Total[4]	840	136.15	—	3,596.42	2,798.0	32.26	2,970

[1]Gevorkiantz, S. R. Tables for determining contents of standing timber in Minnesota, Michigan and Wisconsin. University of Minnesota Agric. Expt. Sta. Tech. Bul. 39. 1926.

[2]Gevorkiantz, S. R. A composite cordwood volume table for pulpwood species in the Lake States. Lake States For. Expt. Sta. Tech. Note 241. 1945.

[3]Round post sizes range from 3 to 8 inches top diameter inside bark and from 6 to 9 feet in length.

[4]Acre values based on a tenth-acre sample.

FIG. 1.—Twenty-four-year-old stand of a hybrid between *Populus alba* and *P. grandidentata*.

growth of 145 cubic feet which is three and one-half times greater than is produced by oak trees on the same site at age 24.

If clearcut, an acre of this hybrid would yield 2,970 posts ranging from 3 to 8 inches top d.i.b. and from 6 to 9 feet long. This represents a production of over 120 posts each year and would supply the posts needed annually on one and one-half average Iowa farms.

Recently a second stand of this hybrid has been located in the NW¼, SW¼, Sec. 21, T68N, R9W, Van Buren County. This stand is some 10 miles west of the first and evidently represents a different clone.

The good form, rapid growth and apparent freedom from disease suggest that these hybrids should receive wide trial.

A. L. McCOMB AND
NORMAN J. HANSEN
Forestry Department,
Iowa State College, Ames

Comments on "Leaf Litter as a Killer"

This stimulating article by Mr. Koroleff deserves study and appreciation. In addition to brief comment as to the physical effects of leaf litter upon coniferous reproduction may I elaborate by telling of our recent experience seeking a new solution of the old and important problem of silviculture in the North—namely, how to establish the more important and valuable conifers by means of natural reproduction on areas dominated by relatively worthless hardwoods. Coniferous and mixed forests are generally transformed into inferior hardwood stands by indiscriminate cutting. "Rough and ready" forestry measures have had little beneficial effect. The best silviculturists of the past have been unsuccessful in adapting a system which assures reproduction of conifers following the cutting of mixed woods. The few minor successes achieved through grazing and by fire have been more by accident than by design. When weighed as possible silvicultural measures these have been quickly dropped by landowners as too strong and dangerous medicine. Not until new chemicals, capable of killing hardwoods cheaply and effectively, were developed did we have even a good theoretical means of dealing with the problem.

On the Pack Forest at Warrensburg, N. Y. in 1950, we seriously set out to learn how to establish white pine by natural reproduction employing chemicals. The particular aim was to establish successful reproduction in mixed woods. Though our white pine conditions undoubtedly differ from Mr. Koroleff's spruce in many ways, still I am convinced that the same kind of approach is applicable and the results are likely to be similar. It now seems reasonable to expect that chemicals offer a universal means of dealing effectively and economically with the hardwood weed problem in the successful establishment of conifers by natural reproduction. Proper modification of timing and determination of proportions are obviously necessary to meet the exacting demands of different species and localities. Leaf litter in a physical sense will unquestionably trap, bury, and smother a large proportion of the coniferous seeds which fall from neighboring seed trees as so aptly described by Dave Smith. Yet our observations are that a considerable number of seedlings manage to come up in the spring after a good seed year, on the hardwood litter under pure hardwood groups which are within the range of white pine seed trees. With no treatment however these over-shaded, anemic seedlings do not become hardened before winter. As every nurseryman knows, pine and spruce seedlings shaded from germination, must be exposed to adequate light in late summer in order to harden up so as to resist winter killing.

We have not tried to determine whether the weak, unconditioned one-year seedlings freeze to death or not. This is purely academic however because the falling hardwood leaves, like so many sheets of overlapping wet paper, crush them down so that they never can rise again. Since spruce and hemlock seedlings are much shorter than white pine, they have even less chance of survival. In either case, there are practically no coniferous seedling survivors after the first growing season on the hardwood litter in our mixed stands.

In the fall of 1950 with a good crop of white pine cones on the trees, we selected as a study area, a 60-year old mixed stand of pine, hemlock, and inferior hardwoods for the purpose of establishing white pine reproduction. The area was typical of millions of acres in the Northeast. It was stocked with trees incapable of producing good sawtimber because of inadequate early stocking and on a site unfavorable to hardwoods. Well stocked with white pine, this same area would be capable of an average yield of close to a thousand board feet per acre per year, as part of an intensively managed forest. But with the present growing stock—no kind of silviculture, however conservative, could conceivably yield more than a small fraction of a hundred board feet of poor quality lumber per acre per year. Unless such areas can be successfully reproduced to a new and vigorous crop of conifers, their future economic value will be limited to providing food for birds and animals. This kind of forest landscape is alleged to have high aesthetic values, but to the silviculturist who appreciates strong, straight healthy timber trees this kind of forest is grotesque. To him it is a horrible example of neglect and waste to allow such diseased, deformed, and decrepit woody vegetables to occupy for decades good forest land otherwise capable of serving the needs of a timber-hungry world.

The plan of treatment for the area was very simple. After the seed fell in September, all the advance-growth hardwoods, from waist-height to pulpwood size were poisoned by applying a mixture of 245T and fuel oil at the base of the stems. This subsequently resulted

in the death of more than 90 percent of these aggressive hardwood weeds. During the winter all sawtimber trees, with the exception of the white pine seed trees, were cut. In the spring peeling season the hardwood pulpwood trees were girdled and sodium arsenite applied to loosen the bark for peeling the following year.

The white pine seed germinated in June in a satisfactory manner over the whole area. Of special interest was what transpired under the pure hardwood groups, consisting largely of hard maple, beech, birch, ash, basswood, etc. On this small area for years past, seed had fallen in abundance but no seedlings had survived. On this forest floor of pure hardwood litter, an adequate number of white pine seedlings now appeared. This time the conditions were different and so were the results. Some extra light was coming in because of the removal of the larger saw-log trees. Then, as the leaves on the poisoned pulpwood trees died and shriveled, more light came in. This time the pine seedlings grew and thrived under favorable light conditions and when fall came they were the largest and most rugged one-year seedlings we had ever seen. There was no great blanket of overlapping wet leaves to smother this crop of seedlings. Most of the dead hardwood leaves from the poisoned trees came down gradually through the summer and the rest remained dead on the branches. When the second growing season began in the spring of 1952, the white pine seedlings shot up as they had never been able to do before. When the pulpwood was removed however, some of the pine seedlings were unavoidably destroyed in skidding, and some were covered with slash. We believe, it would be better in the future to remove all trees to be utilized before seed germination begins, leaving unmerchantable poisoned trees to provide a gradually diminishing shade.

During the first summer after reproduction, as was to be expected, seedlings of many kinds in addition to white pine germinated on the area. The most aggressive of these were raspberry, blackberry, cherry sp., birch sp., along with many annuals, perennials, grasses, vines, and ferns. In some spots the white pine seedlings were fairly well covered by late summer but no treatment was deemed necessary. But, in late June 1952, it was evident that certain spots were in urgent need of weeding. A foliage spray of 245T in water was then applied but very lightly and only to those spots where the weeds were dense and aggressive. This application was both cheap and effective. The rank weed growth was destroyed while the small pine seedlings were left standing practically undamaged. By August 1953, the previously unsprayed parts of the area had become quite heavily covered with weeds and were sprayed. Again the hardwoods went down, leaving the pine substantially unaffected. Late July or early August foliage spraying does a minimum of damage to small pine seedlings and does greatest damage to the hardwood weeds.

It appears that we have succeeded in establishing white pine reproduction in spite of the competition of the hardwood weeds. Undoubtedly the area will need another chemical treatment. We have learned much by our experience and are confident that we can improve upon this first test case. Other tests are in progress at the Pack Forest and more are planned. It is reasonable to expect that the cost of establishing conifers in this way may well be less than the cost of planting. Surely, planting cannot be successful under such conditions without a substantial outlay for weeding. Successful natural seeding will however require foresight, careful planning, and a high degree of technical skill. But that is presumably why we have silviculturists.

These comments are made in the hope that more foresters will become interested in experimenting with the use of chemicals for restoring, through natural reproduction, the more important conifers to our run-down mixed woods in the North. We need no longer feel that we are limited to the planting of old fields and burned-over lands to produce future crops of conifers. We can now begin to think in terms of restoring the desired coniferous species to the most favorable sites where seed trees still remain. One of the most obvious ways for foresters to invest money wisely would seem to be in the intensive development of the best lands available for timber growing. This policy is the undisputed key to successful agriculture. Foresters and silviculturists must always be eager and willing to learn by experiment and experience.

C. H. FOSTER, *Director,*
Pack Demonstration Forest,
Warrensburg, N. Y.

Comments on the Baker Automatic Tree Seed Planter

The Baker automatic tree seed planter, developed by C. S. Baker of Portland, Oregon, was recently tested on several national forests in the Intermountain region. This piece of equipment is a light, portable hand planter. Basically, its operation depends upon rhythmic timing by the person using it to allow a single seed to be automatically selected from a seed hopper and deposited through a vertical shaft to a predetermined spot on the ground. The principle and operation of this planter are demonstrated in Figure 1.

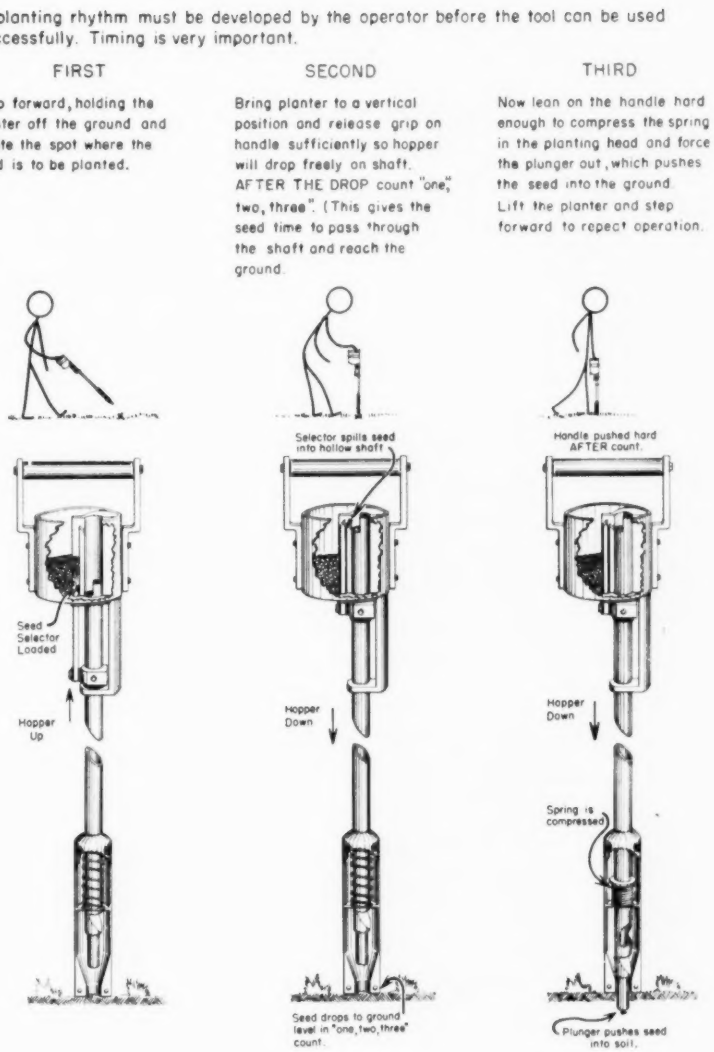
The planter was tested using ponderosa pine (*Pinus ponderosa* Laws.), Jeffrey pine (*P. Jeffreyi* Grev. & Balf.) and lodgepole pine (*P. contorta* Dougl.) seed. Jeffrey pine has one of the largest seed and lodgepole pine the smallest seed of the commercial pine trees in this region.

Conclusions reached from the use of this planter are summarized below:

Advantages.—(1) The planter is light, easy to carry, and can be operated with one hand from a standing position. (2) The planting spot can be selected by the oper-

ator. (3) The job of making a hole and placing the seed in it is accomplished in a single operation. (4) The seed is planted to a known depth, provided the footing (base of the planter) is not pressed below the soil surface. (5) The footing can be removed when planting in firm soils or on areas where grass or brush are a hindrance. (6) With a little care and practice seeding can be done with 1-3 inches of soft snow on the ground when the footing is removed.

Disadvantages.—(1) With ponderosa and Jeffrey pine seed some seed is cut in two by the plunger action in the vertical shaft. This may be caused by a damp seed sticking to the outlet in the bottom of the planter and being cut by the plunger. Seed cutting will be minimized if the seed is dry when placed in the hopper and if the internal parts of the planting head are wiped dry frequently when planting in wet weather. (2) The automatic feed mechanism does not work consistently after the hopper is only one-half to one-third full. This can be remedied if the operator will remember to reverse the planter when the hopper is only one-half full. When this is done the hopper will be in a forward position, instead of to the rear as shown in Figure 1, and seed will reach the selector until the hopper is empty. (3) Seed selectors (a given size of selector is available for seed of each species) are designed to lift but a single seed at a time. Because for seed-spotting it is desirable to plant from 5 to 10 seed at a time, depending upon seed viability and other factors, selectors should be designed and constructed accordingly. (4) Seed is placed too deep in very loose soils, possibly because the footing is not large enough in diameter. (5) The planter is not suitable for use under muddy conditions, especially in sticky, clay soils. (6) The planter does not cover seed with soil, but this can be done by the operator stepping on seed spots with his boot as he walks along.


A planting rhythm must be developed by the operator before the tool can be used successfully. Timing is very important.
FIRST
Step forward, holding the planter off the ground and locate the spot where the seed is to be planted.
SECOND
Bring planter to a vertical position and release grip on handle sufficiently so hopper will drop freely on shaft. AFTER THE DROP count "one, two, three". (This gives the seed time to pass through the shaft and reach the ground.
THIRD
Now lean on the handle hard enough to compress the spring in the planting head and force the plunger out, which pushes the seed into the ground. Lift the planter and step forward to repeat operation.
Seed Selector Loaded
Hopper Up
Selector spills seed into hollow shaft
Hopper Down
Seed drops to ground level in "one, two, three" count.
Handle pushed hard AFTER count.
Hopper Down
Spring is compressed
Plunger pushes seed into soil.

DAVID TACKLE
Intermountain Forest and Range Experiment Station, Forest Service, Ogden, Utah

Points of View

The Master Degree: What Is Behind a Title?

The multiplicity of degrees given by American forestry schools as listed in the November 1953 issue of the JOURNAL[1] might not be serious in itself if there were general understanding or agreement as to the training each degree signifies. However, the present diversity of training represented by a specific degree creates unnecessary misunderstanding within the profession. The Bachelor degree earned on completion of a four-year undergraduate forestry curriculum has been somewhat standardized by the accrediting activity of the Society. Consequently, any question as to the content of the traditional forest management course, regardless of the degree title, is not serious, though two degrees like Bachelor of Forestry and Bachelor of Science—Forest Management from the same institution raise a problem in interpretation.

Master degrees in terms of the number of different kinds are almost as numerous as Bachelor degrees and may be equal in number since only those given in 1952 are listed in the JOURNAL. In the sphere of the Master degrees, however, especially those which designate the area of study as forest management, variations in requirements and content have sown the seeds of criticism, and the profession may reap the harvest of censure unless definitions are spelled out plainly.

The purposes of this article are to examine the Master degrees given in forest management and to suggest a way to avoid the present ambiguity regarding the training each degree designates.

Master degrees take two forms: Master of Forestry and Master of Science, with variations often tacked to the basic title (Master of Forestry—Forest Management; Master of Science in Forestry; Master of Science, major in Forest Management). In at least nine accredited forestry schools, the graduate student has the choice of either an M. F. or an M. S. degree. Although the college catalogues do not always clearly spell out the difference between them, it is generally true that the M. F. provides for a broader training in the general area of forest management while the M. S. is earned by a more detailed study of a limited segment of the field, such as silviculture. Apparently those schools which award only one Master degree must give the same degree to all candidates regardless of variation in background and intensity of training.

The difference in the basic training of students entering graduate work creates a need for a differentiation in degrees earned. The two basic training patterns are as follows: one group of students has completed an undergraduate curriculum in forestry, and a second group has received degrees in subjects other than forestry. Those in the first group usually earn a Master degree in one year with full-time study; no problem arises except perhaps what may be the title of the degree which best expresses their added training. Existence of the second group (those entering graduate work in forestry with a nonforestry background) has raised the important question as to whether they are entitled to a Master degree as their first degree in forestry.

Some institutions have been criticized for giving a Master of Forestry degree to a student having a nonforestry Bachelor degree after two years of technical forestry training in addition to a summer camp and removal of basic science deficiencies. Several considerations may make this criticism unwarranted and unjustifiable. Perhaps first consideration should be precedence since one of the oldest degrees still being given to graduate students without previous forestry training is the Master of Forestry. This degree has more than fifty years of history, and it is a bit late to criticize its basis. There remains only a need for differentiating such training from training superimposed on a forestry background.

A second consideration is that a four-year Bachelor degree forester does not have as broad training as the forester having a Bachelor degree in another field who has continued his college training for an additional two years or more to acquire his technical forestry and M. F. degree. It is unrealistic to assume that the two men have equivalent backgrounds; this would be the assumption if the broader training resulted in earning only another Bachelor degree for the added two or more years of study. The nonforestry Bachelor-degree student is more purposeful, is usually an above-average student, and is usually able to enroll in a few advanced courses before he graduates; and he has the advantage of additional development given by the extra years of study. It is unthinkable that such distinctively different training should go unrecognized. If the advantage had not been reflected in the performance of such individuals, there would have been an early recognition of need for change.

The degree of Master of Forestry is probably the most noncommittal degree title that could be composed. It is common parlance on a campus to call anyone in a school of forestry a "forester" whether he is specializing in wood technology, range, forest management, or recreation. Likewise in the field and in the Society, there is no unanimity of opinion as to the definition of "forestry"; but the general consensus is that forestry is a blanket term under which the multiple-use aspects of wildland management can be associated.

What better title for a degree than Master of Forestry can be given to express a broad background with adequate forest management training? The title expresses no special proficiency, but it does promise that its possessor has added training. No one can argue that a good student who has spent six or seven years in college does not have added training compared to students, especially the large number who barely squeeze through our schools, who have spent only four years. An increasing number of college graduates change their field of interest to forestry; it is recommended, therefore, that the degree Master of Forestry be restricted to differentiating such students from foresters who have advanced technical training.

There would be little criticism of such a limited interpretation of the Master of Forestry degree, if over the years an increasing number of schools had not introduced the Master of Forestry degree with the connotation of its equivalence to the Master of Science, and if the schools which initiated the Master of Forestry degree had been careful to segregate the two types of background. Too frequently in the same school these distinctly dif-

[1] Illick, J. S. They received forestry degrees. Jour. Forestry 51: 809-814. 1953.

ferent backgrounds are ignored by awarding the same degree. It is recognized that in some schools the need for an advanced technical degree other than the M. S. with its usual outside control or stiffer requirements, such as a language, has been met by the M. F. degree and that in choosing the M. F. the history of the degree probably was of no concern.

In order to resolve both potential as well as existing criticism resulting from the ambiguity in interpreting the backgrounds the various Master degrees represent, it is suggested that the following delineations be as widely adopted as school procedures will permit. It is further suggested that the Society of American Foresters go on record as favoring codification of requirements for the Master degree as it has for the Bachelor degree.

First, the Master of Forestry degree shall be limited to those students who have a Bachelor degree in some subject other than forestry and who complete the requirements of an approved forest management B. S. curriculum.

Second, the Master of Forest Management degree might be the degree awarded to a student whose graduate work was preceded by an undergraduate forestry degree. The implication is advanced training in forest management; and, in those schools giving three Master degrees, the Master of Forest Management would represent a deepening of knowledge without intensive specialization. The suggested title would convey the idea of greater depth of technical information without some of the redundancy found in a few degrees now given though other titles succeed in supplying the same idea.

Third, the degree of Master of Science in Forest Management would also be preceded by a forestry undergraduate program; but in both its A (in which a thesis on original work is required) and B (in which the thesis is replaced by reports based on library work) plans it would carry the implication of specialization where a Master of Forest Management is available, or, for lack of a M.F.M., it would connote simply a greater intensity of training in forest management.

If the above suggestions could be implemented, a major source of misunderstandings between schools and within the profession could be eliminated.

T. W. DANIEL,
Utah State Agriculture College,
Logan, Utah

SMOKEJUMPER EQUIPMENT on display at S.A.F. Intermountain Section annual meeting in April.

Art Roberts of the Southern Idaho Timber Protective Association, and Robert Safran, Teton National Forest, are looking over the equipment used by Forest Service smokejumpers.

The dummy is fully equipped for jumping. The helmet, faceguard, padded trousers, and high necked padded coat are all worn for the protection of the individual when landing in trees or brush. The chest chute is used only in an emergency. The back pack chute or escape chute is the one the jumper descends with. The bulge on the right knee is a pocket which contains a coiled rope and a signal strip. The coiled rope is for the jumper to lower himself with should his chute hang in a big tree. The signal strip is used to notify the pilot of the jumper's condition after the descent from the plane. The fire pack contains the smokejumper's 48 hour ration, water, bed, first aid kit, and fire fighting tools. This equipment is dropped with a separate cargo chute to the jumper after he is on the ground.

Reviews

Forest Cover Types of North America.

Report of Committee on Forest Types, F. H. Eyre, Chairman. 67 pp. Society of American Foresters, Washington 6, D. C. 1954. $1.

This bulletin, the culmination of a quarter-century of work by many foresters, gives clear, concise, and adequate description of 156 forest types of the United States, Canada, and Alaska. It supersedes two previous publications of the Society of American Foresters — *Forest Cover Types of the Eastern United States*, the report of a committee under the chairmanship of R. C. Hawley, first published in 1932; and *Forest Cover Types of Western North America*, the report of a committee chairmaned by F. S. Baker, 1945.

The material on western types, which include those of western Canada and Alaska, has been revised by Dean Baker. Revision of type descriptions for the eastern United States was undertaken by the Society's present Committee on Forest Types, under the chairmanship of F. H. Eyre. Type descriptions for eastern Canada have been added through the courtesy of the Canadian Institute of Forestry and a committee chairmaned by A. S. L. Barnes. The present bulletin preserves the many fine features of the earlier reports and combines old and new material in a modernized presentation.

The purpose is to provide a "systematic classification and consistent list of forest types." The meaning of forest type is narrowed down to the cover type, defined as "a forest type now occupying the ground, no implication being conveyed as to whether it is temporary or permanent." In order to be recognized in the list, a type must cover large areas in the aggregate and must be distinctive and easily separated from other types. The finer subdivisions needed in practice can be tied in readily to the general scheme.

The type descriptions cover composition, occurrence, site conditions, successional relations, transition forms, and variants. The effectiveness of the presentation is enhanced by the orderly and meaningful arrangement of the types. The types of eastern North America are placed under five broad forest regions, the Boreal, Northern, Central, Southern, and Tropical Forests. Under each region, the types are grouped by soil conditions in the order of driest to wettest. The types of western North America are arranged in a natural grouping, starting with those of the coldest region and working toward the warmest. Interior regions are separated from coastal areas, and altitudinal zones are distinguished in the mountain regions. Consequently, a thread of natural relationship runs from one type to the next, giving the book continuity and ecological interest.

The principles followed in separating and naming forest types are explained in the introduction, which should be read carefully. Among other helpful accessories are tables of common and scientific names of species (taken from *Check List of Native and Naturalized Trees of the United States (including Alaska)* by Elbert L. Little, Jr., 1953), lists of the cover types as arranged by regions and site conditions, and a comparison of the types used by the Society of American Foresters, by the U. S. Forest Survey, and by Canadian foresters.

Members of the Committee on Forest Types, in addition to Chairman Eyre, are W. A. Dayton, Daniel DenUyl, R. C. Hawley, and P. R. Wheeler. Foresters are grateful to them for this reliable, indispensable, and interesting publication.

WILLIAM D. MILLER,
North Carolina State College.

Economics of the Young-Growth Sugar Pine Resource

By Henry J. Vaux. 56 pp. Illus. Bul. 738. California Agricultural Experiment Station, Berkeley, Calif. 1954. Free.

Although the title indicates a study of primarily regional interest, this bulletin is an outstanding contribution to the literature of forest economics, management, and policy. Its importance stems mainly from the comprehensive method of analysis used in evaluating the economic factors to be considered in the management of a timber species.

The study seeks to determine the combination of sugar pine management efforts, by both public and private landowners, that will yield the greatest net economic return to industry and society. Accordingly, management problems are described, potential markets are analyzed, and the costs of producing various quantities of high quality pine are estimated. This information enables the formulation of an economically sound species-production goal and a description of the areas from which this production should be obtained.

Although blister rust control is recognized as a major management problem, the study clearly demonstrates that an economic evaluation of a single management practice cannot be made in isolation. The advisability of any such practice is shown to depend on associated management practices and on the economic status of the resource itself.

The relationship of sugar pine consumption and three independent variables is determined. The variables selected are gross national product, sugar pine stumpage prices, and an index of the region's competitive position for lumber production. Combining these conclusions with estimates of G.N.P. and the competitive index for the years 2010 to 2069, probable aver-

age annual consumption for various stumpage prices is computed, i.e., a demand schedule for the period is derived.

The study then seeks to determine the investment required to produce various quantities of sugar pine stumpage for sale during the years 2010 to 2069, assuming the most economical management techniques would be used on the most suitable forest land. The effects of such factors as site quality, present stand composition, costs of stand improvement and blister rust control, and probability of rust damage are considered. By determining the additional cost of growing successive additional volumes of sugar pine, an industry marginal cost curve (short-run supply) is derived.

Net economic return will be maximized if management is extended beyond the most productive lands until the costs of producing additional volumes of sugar pine rise to equal the prospective sale price. The study results indicate that this point is found at a price (or additional cost) of $50 per M and an average annual yield of 155 million board feet. Accordingly, if management favored sugar pine on all lands where it could be produced for less than $50 per M (including interest), about 155 million board feet would be produced and the sale price would return the investors' capital and a reasonable rate of return.

Thus 155 million board feet is the growth goal suggested by this study as a guide for public and private action. Methods of selecting the appropriate areas for sugar pine management are described. Logical methods of achieving this goal are also proposed and discussed.

In illustrating an economic approach to the problem of establishing growth goals, the author has made an outstanding contribution. The complexity of the problems associated with the approach are not minimized, and perhaps offer some explanation for the use of simpler though economically less valid methods. Dr. Vaux recognizes that timber growers are a part of society, and thus their production costs and profits are an essential part of the problem of determining an economic growth goal for society; his method gives equal weight to how badly we want more timber (demand) and how much it will cost us to get it (supply).

Foresters concerned with major forest management production decisions, either public or private, or with the research fundamental to the solution of such problems, will benefit by a careful study of the methodology outlined in this publication.

CARL H. STOLTENBERG

Proceedings of the Seventh International Botanical Congress (1950)

Edited by Hugo Osvald and Ewert Åberg. 899 pp. Illus. Chronica Botanica Co., Waltham, Mass. [1954]. $17.35.

The seventh International Botanical Congress was held in Stockholm, Sweden, July 12-20, 1950.

This large volume, almost entirely in English, attractive in typography, quality of paper and format, with a cover embellished with a Linnean vignette, contains much of interest to foresters. Volume of material and cost of publication—the latter partly defrayed by the Swedish government and certain private individuals and companies—have delayed publication.

There are an initial table of contents, covering all phases of the congress, and an editor's preface. Because of the very large number of papers read only those addresses at the plenary meetings and the lectures at the general meetings are given in full; the great majority of talks are given in abstract form. Follow a brief historical "Inception of Congress" and a chapter "The Congress Organization," giving names of officers, of the organizing and other committees and of sections, excursions, number of delegates, and summary of the program. The minutes of "Plenary Sessions" include, among other items, the extraordinary opening address of the president, the distinguished Swedish Prof. C. Skottsberg who, without notes and in rapid-fire style, spoke eloquently in four different languages in succession. Also, the welcoming address of Crown Prince (now King) Gustav. There are chapters on resolutions, votes of thanks, lectures, exhibits, entertainments, excursions, and lists of delegates by countries.

The bulk of the book is taken up with detailed accounts of the sessions of the 15 sections: Agronomy, Cytology, Experimental Ecology, Experimental Taxonomy, Forest Botany, Genetics, Morphology, Mycology and Bacteriology, Nomenclature, Paleobotany, Phytogeography, Phytopathology, Plant Physiology, Taxonomy (both of cryptogams and phanerogams), and Palynology. The book concludes with an index, and is handsomely illustrated.

WILLIAM A. DAYTON

Our Wildlife Legacy

By Durward L. Allen. 422 pp. Illus. Funk & Wagnalls Company, New York. 1954. $5.

Dr. Durward L. Allen, who is presently a biologist with the Fish and Wildlife Service stationed at Beltsville and Washington, is eminently qualified to write on the subject of the management and preservation of our wildlife resource. He has written numerous bulletins on various phases of wildlife management, and particularly on the management of certain species. His most outstanding previous work was *Michigan Fox Squirrel Management*, published in 1943 by the Michigan Department of Conservation Game Division. He is a scientist of unquestioned ability, with the healthy skepticism which is vital to sound appraisal of biological facts.

His book is probably the most important contribution to the science of wildlife management in recent years. It is a worthy successor to Aldo Leopold's *Game Management*. It has numerous advantages

over Leopold's work in that, being later, it can cite the proof for some of the theories in Leopold's work. It has another great advantage, which came from its author. That is, it is highly readable, and in places contains a spicy humor which eloquently emphasizes some essential facts. It tramps on some toes and it kicks the stuffings out of some very sacred theories. It is generous in giving credit to many contributors to our knowledge of the science of wildlife management. Foresters and conservationists, on reading it, will take additional pride in their work.

The book is organized in three parts. The text is almost completely free from footnotes, and reference notes to quotations are detailed in a part of the book devoted to that purpose and keyed to the line and chapter to which they refer. In addition, the more detailed notes have a reference to a bibliography of over five hundred titles. A complete alphabetical index makes the location of information simple.

In closing the book Dr. Allen writes in a somewhat diffident manner of the work of conservationists. He says: "It is a labor of love, for none of them will be rich—except in knowing they helped to do a job they thought was important and necessary."

RICHARD M. MAY

Forestry Theses Accepted by Colleges and Universities in the United States, 1900-1952

Compiled by Katherine W. Hughes. 140 pp. Director of Publications, Oregon State College, Corvallis, Ore. 1953. $1.

It is doubtful whether there exists a more impressive record of the results of graduate education in forestry, together with forestry's closely allied fields, than this excellent publication. To the Oregon State College Library and School of Forestry, the profession of forestry owes a debt of gratitude for a unique and valuable contribution to the professional literature.

In the preface Wm. H. Carlson, director of the College libraries, explains how this publication originated. It grew out of a suggestion by the Society of American Foresters. Two decades ago the Library compiled a list of theses in forestry, largely for the use of the College. It was found useful by other forestry schools, and when the Society suggested bringing the bibliography up to date, the Library with the cooperation of the School of Forestry kindly obliged, and the two College units shared the cost. In addition to Miss Katherine Hughes and other members of the Library staff, Ray A. Yoder and William I. West of the forestry faculty assisted with the subject index.

A grand total of 2638 theses are recorded. As might be supposed, Yale, which has the oldest graduate school of forestry, leads with 21 pages of titles. Duke contributes 14 pages. The State University of New York and the University of Michigan are third with 11 pages each.

So far as the present reviewer can determine, the earliest thesis written by a forester now living was "Some Silvicultural Notes on the Spruce Forests of New England and New York" by R. S. Hosmer, Yale, 1902. It is an interesting commentary that Ralph Hosmer is still intensely interested in this subject. W. B. Greeley's thesis (Yale, 1904) was "The Relation of Forests to Water Supply and Stream Flow," a topic which continued to engage his attention over the subsequent half-century, and still does.

Wholly apart from its scientific value, this excellent publication is a fascinating record of the many aspects of forestry and related fields that have inspired original study by students during the past five decades.

HENRY CLEPPER

New Green World.

By Josephine Herbst. 272 pp. Illus. Hastings House, Inc., New York 22, N. Y. 1954. $4.

Most botanists have been awed at the tremendous accomplishments of Linnaeus, the Father of Botany. It is a fitting study to consider the work of John Bartram whom Linnaeus called the "greatest natural botanist in the world." Miss Herbst has done us a favor in preparing a very readable account of the times and doings of the Bartrams. The father, John Bartram receives the larger attention since he took strong initiative, but William Bartram gets a share of consideration.

The author makes a particular attempt to develop a picture of the times and attitudes of natural scientists in the period 1699 to 1823, spanning the lives of both men. Practically all worthy scientists were inclined to write long, informative letters, and exchange manuscripts and bulk shipments of specimens which somehow usually reached their destinations. In our day we strive for publication in the journals in order to disseminate scientific data and ideas. This is safer, of course, but in the 18th century scientists had remarkable luck in passing information about in carefully prepared letters and files of field notes. Though it was difficult to travel widely, scientists of distant points kept in quite close touch, amid such vigorous wars as that of 1776.

John Bartram was acquainted with Peter Kalm of Sweden, Gronovius in Holland, Buffon in Paris, Peter Collinson in London, as well as Washington, Jefferson, Franklin, Colden, Benjamin Rush, and others in America. Franklin and Collinson were helpfully sympathetic in planning a career for William Bartram. John Bartram, Benjamin Franklin, and seven others founded the American Philosophical Society in 1743 (William was elected a member in 1786). In 1786 Bartram was appointed botanist for the American Colonies by His Most Gracious Majesty George III (perhaps after excessive delay).

John, and later both father and son, made many remarkable exploring and collecting trips. Bartram's scientific travels ranged

through the entire eastern seaboard from the Adirondacks well into Florida. At times he was far inland in New York, Pennsylvania, Maryland, and Virginia. It should be emphasized that he did not limit his work to collecting dead specimens and taking notes. He sent living material all over Europe, embracing everything from viable seeds to transplants and even huge living turtles. Arboretums in Europe and America still contain plants he procured.

Evaluation of this little book according to strict scientific standards would bring sharp criticism. There are a few contradictions and some dates and distances seem improbable. There are several errors in both common and scientific names. Miss Herbst doesn't quite understand the practices we follow in using scientific names. Her lack of adequate technical botany prevents her from correcting little slips like Bartram's habit of calling hemlock by the name "spruce." The bibliography has the superficial appearance of being alphabetical, but many of the items are out of order. Her sources were mainly the older standard works although several recent books would have been better to use.

On the other hand, possibly Miss Herbst reached her stated objective—to catch the philosophy and attitudes of the botanists of that early day. This book is satisfactory for a beginning on the Bartrams but is not the only book available for that purpose. Fortunately, there will be other books to follow, of scholarly nature, through the encouragement of the John Bartram Association and other learned groups.

PAUL C. LEMON.

Decay Studies in Wooden Boats and Ships.

By Div. Forest Pathology, U. S. Dept. Agriculture. Supt. of Documents, Govt. Printing Office, Washington 25, D. C. 1953. 20 cents.

The Bureau of Ships, Department of the Navy, engaged the services of the Division of Forest Pathology, Department of Agriculture, to survey the problem of decay in wooden craft in order to learn possible ways of increasing their service life.

A study was made of several hundred boats of different designs and sizes, and in different situations, with records of their ages, and the species of woods used in their construction. The results have been compiled in a report covering the causes of decay, the factors affecting the likelihood of decay, and the way they can be minimized by improved construction, maintenance, and storage practices. The report discusses the decay resistance of species used for constructing wooden craft and presents comparative records relative to the advisability of not using certain species, particularly red oak.

Design features affecting decay and possible means of improvement are presented. The importance of providing adequate ventilation and fresh water drainage are emphasized as is the use of preservative chemicals. It is also pointed out that when properly done, chemical preservation will open the way for the use of wood species not presently recommended for constructing wooden craft.

All naval activities concerned are using the report as a basic reference in constructing, maintaining, and storing wooden craft. The report has been circulated widely among all government agencies and their contractors but the limited number of copies printed prevents further distribution. However, the more generally applicable portions were summarized before publication in the *Bureau of Ships Journal* of May 1953; copies of which are available.

RICHARD R. HARTLEY,
Bureau of Ships.

Publications of Interest

Forest Service Films, available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C., price 10c, list the various films available on forestry, together with a brief description of their content and nature.

* * *

Tree Planters' Notes Number 16, U. S. Forest Service, is devoted to the subject of nursery machinery and various items of equipment. It should be a practical and helpful reference to the nurserymen.

* * *

The second edition of *Volume Charts Based on Absolute Form Class* has been reproduced by the Louisiana Tech Forestry Club, Ruston, La., and is available for sale at $3.

The first edition of this publication was issued in 1951. It was adapted by S. E. Fogelberg from Tree Taper Based on Hoejer's Formula. The present edition was edited by Prof. Ernest J. Russell of Louisiana Polytechnic Institute with the permission of the author.

The volume charts were developed by Mr. Fogelberg of the International Paper Company for use in the South by foresters of his company. The publication consists of eleven pages of mimeographed instructions between covers, with an attached pocket containing the volume charts and tax table.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

The Forest Industries Are Growing Their Future. By J. L. Madden. 18 pp. American Forest Products Industries, Washington 6, D. C. 1953.

Forest Vistas. 24 pp. Illus. French Residency General in Morocco. 1953.

Forests and the Future in Florida. 17 pp. Illus. Florida Board of Forests, Tallahassee. 1953.

Odoko. . . By J. M. Kryn. 7 pp. U. S. Forest Products Laboratory, Madison, Wis. 1954. Information Leaflet Foreign Woods. Rept. No. 1973. Mimeog.

Quebracho, Quebracho Colorado, Quebracho Macho. . . By J. M. Kryn. 10 pp. Illus. U. S. Forest Products Laboratory, Madison, Wis. 1954. Information Leaflet Foreign Woods. Rept. No. 1969. Mimeog.

Conservation

Let's Give Forest Conservation a Hand. 10 pp. Illus. Empire State Forest Products Association (N. C. Brown, Sec. 122 Dorset Rd., Syracuse 10, N. Y.) 1954.

Forest Economics

Southern Hardwood Lumber Prices 1938-1952 Inc. By H. B. Steer. 21 pp. U. S. Forest Serv., Div. of Forest Economics, Washington 25, D. C. 1953. Mimeog.

Statistical Tables on Western Wild Land Resources By J. O. Lammi. 14 pp. Intermountain Forest & Range Expt. Sta., Ogden, Utah. 1953. Research Paper No. 31. Mimeog.

Forest Products

Progress in Development of Efficient Turpentining Methods. By A. G. Snow, Jr. 35 pp. Southeastern Forest Expt. Sta., Asheville, N. C. 1954. Station Paper No. 32. Mimeog.

Forest Management

Management Plan Rapid Creek Working Circle Black Hills National Forest. 49 pp. & Suppl. U. S. Forest Serv. Region 2, Denver, Colo. 1953. Mimeog.

Some Aspects of Managing Second Growth Woodlands in Upper Michigan. By F. R. Longwood. 17 pp. Lake States Forest Expt. Sta., St. Paul, Minn. 1953. Sta. Paper No. 29. Mimeog.

Pathology

Lumber Stains and Their Control in Northern White Pine. By R. A. Zabel. 3 pp. Reprinted from Journal of the Forest Products Research Society, Box 2010, Madison, Wis. Sept., 1953.

Protection

Atmospheric Conditions Related to Blow-up Fires. By G. M. Byram. 31 pp. Southeastern Forest Expt. Sta., Asheville, N. C. 1954. Sta. Paper No. 35.

Burning Index Ratings in Fire Control Planning. By J. A. Mitchell. 13 pp. Lake States Forest Expt. Sta., St. Paul, Minn. 1953. Sta. Paper No. 28. Mimeog.

Instructions for Using Forest Fire Danger Meter Type S. By J. J. Keetch. 7 pp. Southeastern Forest Expt. Sta., Asheville, N. C. 1954. Sta. Paper No. 33.

Range Management

Grass, the Rancher's Crop. By J. S. McCorkle. 8 pp. Illus. Supt. of Documents, U. S. Govt. Print. Off., Washington 25, D. C. U. S. Dept. of Agric. Leaflet No. 346. Jan. 1953. 10 cents.

Introductory Bibliographies in Range Management and Plant Ecology. 1, Grass Seed Germination Studies; 2, Range Management Literature, 1890-1905. By A. A. Beetle. 18 pp. Wyoming Range Mangt., Laramie. Nos. 65 & 67. Dec. 1953, Feb. 1954. Mimeog.

Methods of Supplying Phosphorus to Range Cattle in South Texas. By E. B. Reynolds and others. 16 pp. Illus. Texas Agric. Expt. Sta., College Station, Tex. Bul. No. 773. Oct. 1953.

Performance of Several Forage Species on Newly Burned Lodgepole Pine Sites. By A. B. Evanko. 7 pp. Illus. U. S. Forest Serv. Northern Rocky Mtn. Forest & Range Expt. Sta., Missoula, Mont. Res. Note No. 133. Dec. 1953. Mimeog.

Report of the Western Forage Crops Committee of the Experimental Farms Service. 198 pp. Canada Dept. of Agric., Ottawa. 1953.

A Test of Borax Control of Goatweed. By A. B. Evanko. 5 pp. U. S. Forest Serv., Northern Rocky Mtn. Forest & Range Expt. Sta., Missoula, Mont. Res. Note No. 134. Dec. 1953. Mimeog.

Silviculture

Direct Seeding of Pines in the Central Hardwoods Region. By L. S. Minckler and A. G. Chapman. 20 pp. Illus. Central States Forest Expt. Sta., Columbus 15, Ohio. 1954. Tech. Paper No. 140.

Forest Planting on Strip-Mined Land in Kansas, Missouri, and Oklahoma. By F. B. Clark. 33 pp. Illus. Central States Forest Expt. Sta., Columbus 15, Ohio. 1954. Tech. Paper No. 141.

The JOURNAL is indebted to Mr. A. C. Hull of the Forest Service Division of Range Management Research for compiling the Range Management Section of Current Literature during the absence of Miss Flick on her trip to England.

An Investigation into Thinning Cycles for Young Chir (Pinus Longifolia) at New Forest, Dehra Dun. By V. S. Krishnaswamy and G. S. Mathauda. 10 pp. Manager of Publications, Delhi. 1953. Indian For. Bul. No. 172. As.-/14/-or 1 sh. 3d.

Methods of Establishing Plantations of Hybrid Poplar Cuttings. By F. E. Cunningham. 10 pp. Northeastern Forest Expt. Sta., Upper Darby, Pa. 1954. Sta. Paper No. 66. Mimeog.

Om Tidsåtgången vid Sådd av Skogsfrö On the Time Consumption of Sowing Forest Tree Seed. (English summary). By Georg Callin. 43 pp. Statens Skogsforskningsinstitut, Stockholm. 1953. Meddelanden Bd. 43, Nr. 7. 2:-kr.

Storage and Germination of Douglas-Fir Seed in Central Idaho. By A. K. Wilson. 3 pp. Intermountain Forest & Range Expt. Sta., Ogden, Utah. 1953. Research Note No. 5. Mimeog.

Soils

Forest Soil Profiles (1). 28 pp. Illus. Forest Expt. Sta., Meguro, Tokyo, Japan. 1952.

Sampling Procedures and Methods of Analysis for Forest Soils. By The Forest Soils Committee of the Douglas Fir Region. 38 pp. Univ. of Washington College of Forestry, Seattle. 1953. Mimeog.

Wood Technology and Utilization

Brief Descriptions of Some Fire-Test Methods Used for Wood and Wood-Base Materials. By L. J. Markwardt, H. D. Bruce and A. D. Freas. 21 pp. Illus. U. S. Forest Products Laboratory, Madison, Wis. 1954. Rept. No. 1976. Mimeog.

The Influence of Specific Gravity and Rate of Growth Upon the Mechanical Properties of Sugar Maple in Flexure. By B. M. Radcliffe. 26 pp. Purdue Univ. Agric. Expt. Sta., Lafayette, Ind. 1953. Sta. Bul. No. 597.

Proposed New Methods for Determination of the Stiffness of Timber Beams and the Strength of Wood Columns. By B. M. Radcliffe. 21 pp. Purdue Univ. Agric. Expt. Sta., Lafayette, Ind. 1953. Sta. Bul. No. 596.

Subject-Matter Index for Dry-Kiln Operators. By R. C. Dietz. 8 pp. U. S. Forest Products Laboratory, Madison, Wis. 1954. Rept. No. 1975. Mimeog.

The Use of Wood Chips in Agriculture. Report of Conference at Syracuse, New York October 9, 1953. 96 pp. Northeastern Wood Utilization Council, Inc., Box 1577, New Haven, Conn. 1954. Bul. No. 41. $2.00.

Wood Anatomy of the Juglandaceae Indigenous to the United States. By E. W. Stark. 42 pp. Illus. Purdue Univ. Agric. Expt. Sta., Lafayette, Ind. 1953. Sta. Bul. No. 595.

Society Affairs

Officers and Members of the Council, 1954-1955

E. L. Demmon, *President*
Southeastern Forest Experiment Station
Federal Building
Asheville, N. C.

William J. Brown
Woodlands Department
Kimberly-Clark Corporation
Neenah, Wis.

C. Huxley Coulter
Florida Forest Service
Tallahassee, Fla.

D. B. Demeritt
Dead River Company
6 State Street
Bangor, Me.

DeWitt Nelson, *Vice President*
Department of Natural Resources
State Building 1
Sacramento, Calif.

Stanley G. Fontanna
School of Natural Resources
University of Michigan
Ann Arbor, Mich.

Percy D. Hanson
U. S. Forest Service
Federal Building
Missoula, Mont.

Edwin F. Heacox
Weyerhaeuser Timber Company
Tacoma 1, Wash.

Henry Clepper, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N. W.
Washington, D. C.

Joseph S. Illick
State University of New York
College of Forestry
Syracuse 10, N. Y.

J. Herbert Stone
U. S. Forest Service
Post Office Building
Portland 8, Ore.

Rutherford H. Westveld
Department of Forestry
University of Missouri
Columbia, Mo.

The President's Column

E. L. Demmon

No aspect of the Society's current activities is of greater interest to me personally than its study of the status, accomplishments, and needs of forestry research in America, being made in cooperation with the National Research Council. After nearly forty years of employment in private and public forestry research, my pleasure in anticipating the completion of this study during my term as president of the Society is only natural.

Over the years the Society has had a continuing interest in research. Among the objectives adopted when the Society was founded in 1900 was "to promote the science of forestry in America."

A special committee of the Washington Section of the Society prepared a comprehensive report, *A National Program of Forest Research*, published in November 1926. This report stimulated nation-wide interest in the subject and led to the passage by Congress of the McSweeney-McNary Forest Research Act in May 1928. This act provided the basic charter for the development of a nation-wide program of research in forestry in the United States.

The pages of the Journal of Forestry have been widely used for the publication of the results of various forestry studies and investigations. By so doing it has served to disseminate the latest research findings and keep the readers abreast of professional progress. A recent study of authorship of Journal technical articles revealed that about one-third of the authors were engaged in research activities, mostly in the employ of public agencies.

Research workers are among the staunchest supporters of the Society. Their contributions to local and national Society programs and affairs have been far greater proportionately than their numerical membership in our organization. Currently it is estimated that about 750 Society members are working full time in research in forestry and in closely allied fields.

The importance of research to the progress of forestry in America has become generally recognized. Whereas most of the early research carried on in this country was by the U. S. Forest Service, in recent years the state agricultural experiment stations, forestry schools, and the forest industries have greatly expanded their research programs.

Many millions of dollars are being expended annually for forestry research in this country. Much of this is in the field of applied research, as it well should be. However, if maximum progress is to be made in the years ahead there is need for further expansion also in fundamental or basic research, aimed at the discovery of natural laws or principles leading to new knowledge.

The Society's current study of forestry research began early in 1953 and is being financed under a grant of $30,000 from the Rockefeller Foundation. It is being headed by Dr. Frank H. Kaufert, director of the University of Minnesota School of Forestry, who is on leave of absence while working on this Society project. He is being ably assisted in the collection and compilation of information by William H. Cummings, another Society member. Society members visited are urged to give these men information on research programs, use made of research findings, and opportunities for additional research. It is anticipated that the field work connected with this Society project will be completed shortly and the report should be drafted by the end of 1954.

We still have much to learn in forestry. There are many ways of improving present forestry practices—doing them better, faster, and at less cost. Research cannot wait until practice catches up with knowledge—it must anticipate future needs. The Society's current study of research should mark another milestone of progress in the development of scientific forestry in America.

E. L. Demmon

FISCAL YEAR MEMBERSHIP CAMPAIGN

SECTION BOX SCORE

Section	Proposed 1954 quota	Applications Received[1] July listing	Total fiscal year
Allegheny	100	17	57
Appalachian	100	2	44
Central Rocky Mountain	45	2	24
Central States	110	7	73
Columbia River	140	3	45
Gulf States	105	3	49
Inland Empire	30	1	37
Intermountain	30	0	11
Kentucky-Tennessee	30	0	3
New England	95	0	48
New York	65	11	39
Northern California	120	0	30
Northern Rocky Mountain	30	6	34
Ozark	55	5	39
Puget Sound	80	7	55
Southeastern	145	5	111
Southern California	20	0	2
Southwestern	35	1	7
Upper Mississippi Valley	60	0	53
Washington	45	1	7
Wisconsin Upper Michigan	60	0	4
Total	1,500	71	772

[1]Student, Junior, Affiliate, Associate (initial) grades only.

FISCAL YEAR MEMBERSHIP CAMPAIGN

SCHOOL BOX SCORE

School	Student Applications Received July listing	Total fiscal year
Alabama Polytechnic Institute	0	6
University of California	9	20
Colorado A & M College	2	17
Duke University	1	12
University of Florida	0	16
University of Georgia	2	35
University of Idaho	1	28
Iowa State College	0	26
Louisiana State University	0	14
University of Maine	0	15
University of Massachusetts	0	16
Michigan State College	0	25
University of Michigan	5	17
University of Minnesota	0	19
University of Missouri	2	19
Montana State University	1	18
State University of New York	8	23
North Carolina State College	0	19
Oregon State College	0	16
Pennsylvania State University	10	32
Purdue University	0	18
Utah State Agricultural College	3	8
University of Washington	1	26
West Virginia University	6	14
Yale University	0	2
Totals	39	461

Henry Schmitz Awarded Honorary D.Sc.

Henry Schmitz, president of the University of Washington and former president of the Society of American Foresters, was awarded the honorary degree of doctor of science by the University of Alaska at the University's commencement ceremony on May 17.

Dr. Schmitz's long career in education includes the professorship of forestry at the University of Idaho, and subsequent assignment as professor and later chief of the School of Forestry at the University of Minnesota. He was later dean of the College of Agriculture, Forestry, and Home Economics at the University of Minnesota, and has been president of the University of Washington since 1952. A Fellow of the Society of American Foresters, he was president of the Society 1942-1945, and is a former editor-in-chief of the JOURNAL OF FORESTRY.

Annual Meeting
Society of American Foresters
Milwaukee, Wis., October 24-27, 1954

An attendance of 1,000 members, their ladies, and guests is expected at the fifty-fourth annual meeting of the Society, to be held in Milwaukee, Wis. October 24-27.

The following information about the meeting should enable members to make their plans to attend and to request room reservations. Additional information will appear in subsequent issues of the JOURNAL.

Milwaukee is easily accessible by airlines, railroads, and highways.

Schedule of Events

Those expecting to attend the meeting are urged to arrive in Milwaukee on Sunday, October 24, or not later than the morning of Monday, October 25. The open meetings start on Monday morning.

As will be seen from the following schedule of events, there will be numerous meetings and sessions arranged so as to provide attractions for a diversity of interests. The August issue of the JOURNAL will contain the complete program of topics and speakers.

Sunday, October 24

S.A.F. Council, morning and afternoon meeting.

JOURNAL OF FORESTRY Editorial Board, evening conference.

Committee on Accrediting, evening conference.

Joint meeting of Council and Section delegates, evening.

Association of Consulting Foresters, evening.

State Forestry Association Executives, afternoon and evening.

Monday, October 25

General meeting, morning.
Society Affairs session, afternoon.
Division of Education, evening.
Division of Public Relations, evening.
Division of Watershed Management, evening.

Tuesday, October 26

Division of Forest Products, morning.
Division of Forest Recreation, morning.
Division of Silviculture, morning and afternoon.
Division of Private Forestry, afternoon.
Division of Forest-Wildlife Management, afternoon.
Social evening and college alumni get-togethers, evening.[1]

Wednesday, October 27

Division of Economics and Policy and Division of Education, joint meeting, morning.
Division of Forest Management, morning and afternoon.
Division of Range Management, afternoon.
S.A.F. Social Hour and Dinner, evening.

Ladies' Events

Ladies are cordially invited. There will be a special ladies lounge in the Schroeder Hotel with local hostesses on hand.

A tea has been arranged for Monday afternoon, October 25, to be followed by bridge, and possibly an evening concert.

On Tuesday, an auto tour with luncheon on the lake shore and a drive through Brown Deer Park and Wauwatosa. That evening members and their ladies have been invited to an evening of conviviality as the guests of the Milwaukee breweries.

On Wednesday morning there will be a tour of one of Milwaukee's art museums, followed by movies and lectures on the nationalities, customs, and costumes of Wisconsin, and on regional art. That evening the annual Society reception and dinner will be held in the Schroeder Hotel.

[1]Members and their ladies will be guests of the Milwaukee breweries. More information about this later.

Society of American Foresters
Annual Meeting
Milwaukee, Wis., October 24-27, 1954

_____, 1954

First Choice Hotel _____

Second Choice _____

Third Choice _____

Please make a reservation for the following room accommodations

a.m.

for arrival on October _____ p.m. Departure date, October _____.

I understand that accommodations will be provided at the daily rate specified, if available; otherwise the next nearest rate will apply.

_____ Single room with bath. Rate $ _____.

_____ Double-bed room with bath. Rate $ _____.

_____ Twin-bed room with bath. Rate $ _____.

_____ Suite (parlor, twin-bed room, and bath). Rate $ _____.

_____ Other (specify accommodations desired). _____

_____. Rate $ _____.

The above room accommodations are requested for the following persons, in addition to myself. (Print or type names and addresses legibly.)

_____

_____

_____

My name: _____

Street address: _____

City, zone, state: _____

Hotel Reservations

All scheduled events will be held in the Schroeder, a hotel of 850 rooms. However, the Schroeder will not be able to accommodate all those attending the meeting, hence other hotels are cooperating.

Members should send reservation requests direct to the hotel of their choice. The reservation coupon printed herewith is for their convenience. Those who do not wish to clip the coupon from the JOURNAL may request a reservation by supplying the necessary information.

In any case, be sure to list first, second, and third choice hotels, and identify yourself as attending the meeting of the Society of American Foresters.

There follows a list of cooperating hotels in Milwaukee and their daily rates. They are listed according to size, and their convenience to the Schroeder. All room prices quoted are with bath, unless otherwise noted. Some hotels have rooms with connecting bath at lower rates.

If any Society member has difficulty in obtaining suitable hotel reservations, please write to Edward Ritter, chairman of the Committee on Hotel Reservations. His address is U. S. Forest Service, 623 N. 2nd Street, Milwaukee 3, Wis.

Hotels

Schroeder Hotel, 509 West Wisconsin Avenue, Milwaukee 3. Single, $5 to $10; double, $7 to $10; twin beds, $8.50 to $12. Suites available.

Wisconsin Hotel, 720 North 3rd Street, Milwaukee 3. (Three blocks from Schroeder.) Single, $4.50 to $8; double, $6.50 to $10; twin beds, $9 to $10.

Medford Hotel, 607 North 3rd Street, Milwaukee 3. (Three blocks from Schroeder.) Single, $4 to $5; double, $6 to $7; twin beds, $7.50 to $9.

Plankinton House, 609 North Plankinton Avenue, Milwaukee 3. (Five blocks from the Schroeder.) Single, $5 to $10; double, $7 to $8.50; twin beds, $8 to $12.

Pfister Hotel, 424 East Wisconsin Avenue, Milwaukee 2. (Eight blocks from the Schroeder.) Single, $5 to $9; double, $7 to $10; twin beds, $7.50 to $12.

Tower Hotel, 11th & West Wisconsin Avenue, Milwaukee 3. (Six blocks from the Schroeder.) Single, $4.50 to $5; double, $5.50 to $7; twin beds, $6.50 to $8.

Towne Hotel, 723 North 3rd Street, Milwaukee 3. (Three blocks from the Schroeder.) Single, $4 to $6; double, $5 to $6.50; twin beds, $6.50 to $8.

In addition to the foregoing hotels, there are other good hotels outside the downtown area, and smaller hotels within the downtown area. A complete list of all city hotels and their rates may be obtained from the Convention Bureau, Milwaukee Association of Commerce, 611 North Broadway, Milwaukee 2, Wis.

Motels

Within a radius of fifteen miles from the Schroeder Hotel are at least two dozen motels and tourist courts with rates varying from $5 to $9 for a party of two.

A list of these motels can be obtained from the Association of Commerce, whose address is given above, or from the S.A.F. Committee on Hotel Reservations, the chairman of which is Edward Ritter, U. S. Forest Service, 623 N. 2nd Street, Milwaukee 3, Wis.

Meeting Committees

The general chairman for the meeting is H. Dean Cochran, regional forester, U. S. Forest Service, 623 North 2nd Street, Milwaukee 3, Wis.

Assisting him are the following committees and their personnel.

Program Committee

The chairman of the program committee is Kenneth P. Davis, School of Natural Resources, University of Michigan, Ann Arbor, Mich.

The other members are Bruce G. Buell, H. E. Ochsner, Clarence Prout, and L. E. Sawyer.

Arrangements Committee

The chairman of the Committee on Arrangements is Merle S. Lowden, U. S. Forest Service, 623 North 2nd Street, Milwaukee 3, Wis.

Assisting him is H. J. MacAloney and heading up the special task committees are the following:

Publicity: H. K. Pyles.
Reception: Fred G. Wilson.
Entertainment: Stanley Locke.
Hotel Reservations: Edward Ritter.
Meeting Rooms: John Von Bargen.
Field Stops: Allan Haukom.
Ladies Events: Mrs. Ray Bassett.

Forestry Exhibits Featured at Intermountain Section Meeting

Forestry equipment, wood products, and the results of research were displayed at the 4th annual meeting of the Intermountain Section at Twin Falls, Idaho, on April 3. The exhibitors were the Boise and Payette National Forests, the Idaho State Forester, Intermountain Forest and Range Experiment Station, Penta Post and Treating Company, Caldwell Lumber and Box Company, and Universal Safety and Fire Equipment Company. On display were smokejumper equipment, photos of the work of the Idaho state foresters, specimens of pine butterfly larvae feeding on ponderosa pine needles, forage on winter range and its relation to deer survival, the effect of moderate grazing on range and livestock condition in the Utah desert, plant cover requirements on Idaho watersheds, chemically treated lumber and posts, sawmill byproducts, and equipment for fire control, safety, and first aid.

The registered attendance consisted of 108 men and 5 women, representing various federal services, industry, the forestry departments of Idaho and Utah, the Southern Idaho Timber Protective Association, Idaho Wildlife Federation, and Utah State Agricultural College.

Topics discussed at the technical meeting included snow hazards, water management, forest wildlife, timber surveys, and entomology. Avalanche hazard management was described by Montgomery Atwater, avalanche forecaster of the Wasatch National Forest. The subject presented by A. R. Croft, forester, Region 4 of the U. S. Forest Service, was "Water Control, a Neglected Phase of Forest and Range Management." Levi Mohler, who is in charge of big game management for the Idaho Fish and Game Department, discussed the dependency of wildlife on good land use practices. "A Survey of Forest Resources in South Idaho" was described by Harry W. Camp, Jr., chief of the Division of Forest Economics, Intermountain Forest and Range Experiment Station of the U. S. Forest Service. Leslie W. Orr, who is forest entomologist at the same Station, presented an illustrated talk on the pine butterfly in southern Idaho.

Guest speaker of the evening banquet was Theo H. Wegener, president of the Idaho Wildlife Federation. Mr.

what makes the Allis-Chalmers AD-40 outstanding for forestry service...

THE ALLIS-CHALMERS AD-40 MOTOR GRADER IS DESIGNED WITH THE POWER, STRENGTH AND DEPENDABILITY NEEDED FOR SERVICE IN THE WOODS

Full 104 Brake HP gives this modern grader the power and speed to get jobs done, even on steep grades or in soft or rough going.

Built Rugged for Tough Assignments—Exclusive single-member tubular frame absorbs sudden shocks and the stress of heavy blade loads. Heavy-duty clutch, transmission and final drives also back up big blade capacity. The AD-40 is built throughout for the kind of dependability that counts when working far from service facilities.

Hugs the Ground on Steep Grades—the AD-40's low center of gravity gives it ground-hugging ability second to none. Plenty of traction and stability help resist side thrust, add to maneuverability.

Easy on the Operator — Power steering absorbs the wheel shocks, lets operator work with minimum of effort. "Pilot house" visibility lets him see the front wheels and both ends of the blade —sitting or standing. Operator's seat and steering wheel are adjustable, platform is roomy, controls are easily reached.

Handles BIG Loads — The AD-40 has balanced power, weight and traction to move bigger loads — rolling-action moldboard keeps load "live" and rolling freely for best use of the power — higher-arch front axle and ample throat clearance to permit the large windrows.

Let us send you complete information about the AD-40 — or your Allis-Chalmers dealer will be glad to give you the complete story.

AD-40

104 brake hp • 23,000 lb

6 forward speeds to 20.4 mph • 3 reverse speeds to 7.0 mph

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

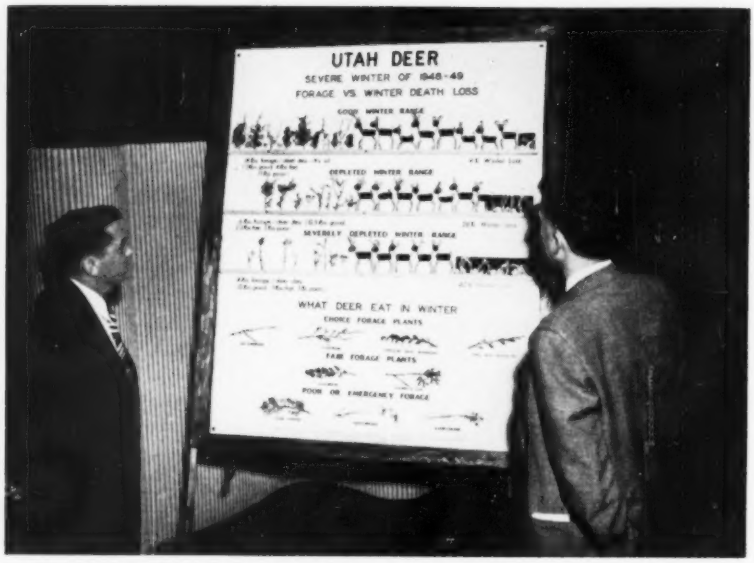
THE LOWTHER
TREE PLANTER PLANTS
10,000 SEEDLINGS PER DAY!

With the Lowther Tree Planter, trees are properly planted for maximum survival in any soil because they have been given the right start.
Three distinct models available to cover all soil conditions and terrain.

●

For details, write:
THE HARRY A. LOWTHER COMPANY
INDUSTRY AVE., JOLIET, ILL.
By The Makers Of The Famous Lowther C-Saw

SILVA COMPASS
Simpler — More Accurate
Recommended by foresters for cruising. Easier to use, faster, positive. Direct course readings. *Write for free literature and instructions.*
SILVA, INC., Dept. J, LaPorte, Ind.
RANGER



THIS EXHIBIT displayed at the Intermountain Section annual meeting demonstrates the relation between range condition and deer losses in severe winters. On range in fair condition winter deer loss was 9 percent. On depleted range the loss was 26 percent and on severely depleted range 42 percent of the deer herd died.

The exhibit is based on research data of the Intermountain Forest and Range Experiment Station and the U. S. Fish and Wildlife Service. Scouts of Troop 56, Ogden, Utah prepared the models as a conservation good turn.

Wegener spoke of the importance of the wildlife resource and the contribution of the Idaho Wildlife Federation to the management of this resource.

The chairman of the Intermountain Section, James D. Curtis, was in charge of the annual meeting. The program chairman was J. Whitney Floyd of Utah State College. Local arrangements were handled by Charles I. Daugherty, supervisor of the Sawtooth National Forest.

Report of Gulf States Section Meeting

The annual meeting of the Gulf States Section, possibly the best attended meeting of any individual Section in the history of the Society, was held at and near Alexandria, La. on May 6 and 7. The box score showed that the attendance included 368 foresters, 139 ladies, and 118 nonmember exhibitors, for a total of 625.

The first day of the meeting was devoted to an equipment demonstration on the Kisatchie National Forest. Featured were the products of dozens of companies specializing in logging and forest fire fighting machinery and equipment. Also on display were hundreds of types of instruments used in forestry, shown in special booths in the Bentley Hotel. On the evening of Thursday, May 6, all those attending the equipment demonstration were guests at a barbecue served in the woods. Including ladies and other visitors, more than 800 persons were served.

On Friday morning, May 7, the business meeting of the Section was devoted to reports of special and

TREE MARKING AXES
The modern method for marking trees. Eliminate all paint problems by blazing and stamping trees with your brand. Nothing to carry but a light 2 lb. axe. 4" cut, 27", 23" or 18" handles. Priced at $10 each with one 1½" or two ¾" hardened characters on head. Special designs quoted upon request.
A. R. SMITH 10003 S. E. ECKLER AVE. PORTLAND, ORE.

BERNARD Kamp-Pack
"OUTDOOR FOOD" HELPS RANGERS, FORESTERS, TRAVEL LIGHT and FAST
Delicious non-perishable food is concentrated for easy carrying. 25 pounds finished food weighs only 9 pounds. Nothing to add but water. 12 full meals in waterproof foil packets. Used by forest rangers as regular food for lookouts, emergency food when fire-fighting. Used by foresters, too.
Write for KAMP-PACK booklet and Bernard INSTITUTIONAL FOOD LISTS for *he-man* lumberjack meals.
BERNARD FOOD INDUSTRIES . . . 2 plants to serve you
P. O. Box 487, San Jose, Calif. • 559 West Fulton Street, Chicago 6, Ill.

standing committees. Chairman W. M. Palmer presided. Representing the national Society were President E. L. Demmon and Executive Secretary Henry Clepper.

New officers elected and installed at the business meeting were chairman James E. Bryan, Jr., Dantzler Lumber Company, Parkinston, Miss.; vice chairman Richard C. Allen, 546 Main Street, Philadelphia, Miss.; and secretary-treasurer James S. Therrell, Box 16, State College, Miss.

The technical session on the afternoon of May 7 was under the chairmanship of Charles A. Connaughton. Featured speakers were Clyde M. Bell of Western Union, T. E. Bercaw of Gaylord Container Corporation, T. N. Busch of International Paper Company, and H. H. Jefferson of the American Pulpwood Association.

Some 420 members and guests attended the Section's annual dinner held that evening in the Hotel Bentley. R. Vance Miles, Jr. was master of ceremonies. The entertainment included a "gridiron show" put on by local members and an informal dance.

W. L. Gooch (1887-1954)

Winslow L. Amont Gooch of West Point, Va., died at his home on May 17 following a heart attack. He was 66 years of age. Born in West Medford, Mass., Mr. Gooch attended the University of Maine and also the University of Michigan, where he received his M.S.F. degree in 1912. After brief periods of employment with the U. S. Forest Service and a pulp and paper company, he became forester for the Elk River Coal and Lumber Company of Dundon, W. Va. During the period 1926-1929, he was a district forester with the Virginia Forest Service and, in the latter year, was appointed forester for the Hummel-Ross Fibre Corporation of Hopewell, Va. Following a year of consulting forestry work, he then became forester for the Chesapeake Corporation of West Point, Va.

Prior to the beginning of World War II, Mr. Gooch again entered private consulting work, and was on several foreign assignments for various government agencies in western Europe, in China and Korea, and in Africa. His latest assignment was as forest products utilization specialist for the Mutual Security Agency in cooperation with the Philippine Bureau of Forestry. His report, published in 1953, was entitled *Forest Industries of the Philippines.*

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of May are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of August 1, 1954. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

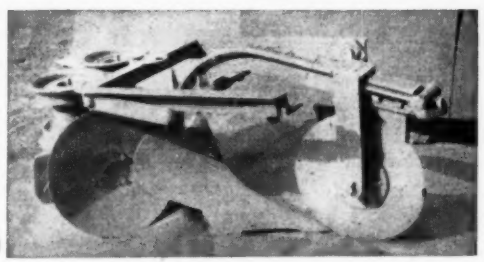
Donovan, D. H.	Kocjancic, E. F.
Emig, C. W.	Miller, W. F.
Eyster, R. E.	Reynolds, T. A.
Fox, J. F.	Sorokach, M. R.
Frank, R. M.	Vogel, V. R.

WEST VIRGINIA UNIVERSITY

Andre, J. E.	Ruckel, J. M.
Deitz, J. E.	Scott, B. T.
McElwee, R. M.	Waite, T. M.

Junior Grade

Cummings, G. L., 440 E. Pearl, Butler, Pa.; Penn State, B.S.F., 1953.



STOP THAT FIRE

RANGER PAL JR. FIRE PLOW

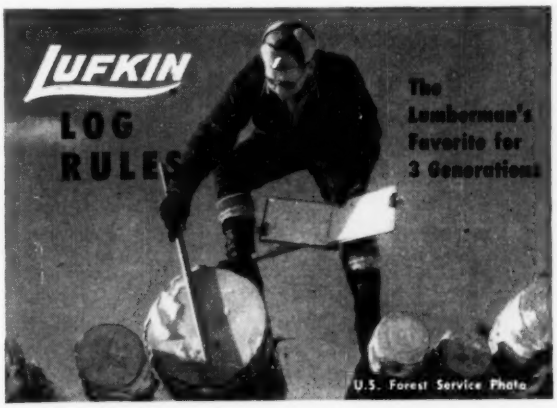
The Ranger Pal Junior fire plow is a hand or hydraulic lift middle-buster with coulter and discs. Drawbar connection built of 1" cast steel T-beam. Has 16" coulter roller bearing assembly with grease seal, mounted ahead of 14" tempered steel middle-buster, capable of cutting large underground roots. One 16" harrow disc bearing assembly is mounted on each side and slightly behind the middle-buster wing which turns the sod over and out. Depth of plowed line may be adjusted by either the presence or absence of two spool weights attached on rear of plow. Leaves a 5 foot earth line and can be drawn by any piece of light equipment, Ford type tractor, jeep or power wagon. Built compact and sturdy for ease in handling and reduced maintenance costs. Tested and proven by Louisiana Forestry Commission. Made by makers of Ranger Pal Fire Plow. Not designed to supersede the Ranger Pal but adapted for lighter equipment. Mass production price at $385.00 each, f.o.b. shop. Workmanship guaranteed.

Ranger Pal Fire Plow production price at $495.00 each f.o.b. shop. Write for further details on both plows.

TWIN CITY WELDING & MACHINE SHOP

301 Jonesboro Highway

WEST MONROE LOUISIANA



Lumbermen and foresters the world over rely on LUFKIN measuring devices for accuracy and quality. Numerous styles of Log Rules, as well as many varieties of Board Rules, Tree Tapes, Log Calipers, Lumber Gages, Cruiser Sticks, Folding Log Rules, and Steel Tapes, provide a choice that give you exactly what you want.

BUY LUFKIN TAPES • RULES • PRECISION TOOLS From Your Supply House

259 THE LUFKIN RULE COMPANY, SAGINAW, MICH.
132-138 Lafayette St., New York City - Barrie, Ont.

FREE BOOKLET

The Lufkin Rule Co., Saginaw, Michigan

Gentlemen: Please send me your free 12-page booklet on Lufkin Board and Log Rules.

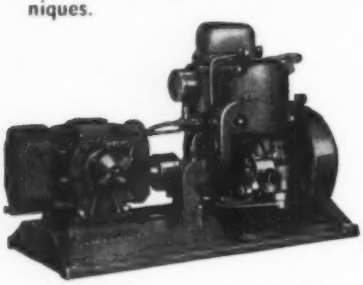
Name_____

Address_____

City_____ State_____

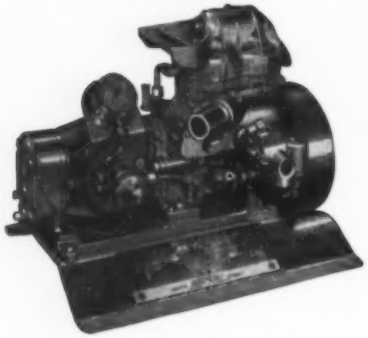
PACIFIC PUMPERS
famous for power plus portability

MODELS "Y" and "5-A"—are the two most popular Pacific Pumpers in the field . . . used and proven by private and public fire protection agencies throughout the world. Both are lightweight, perfected for dependable operation and adaptable to all modern accessories and techniques.



Above: Model "Y" . . . medium weight (70 lbs.) for portability with power . . . 63 g.p.m. at 100 p.s.i. to 20 g.p.m. at 225 p.s.i.

Below: Model "5-A" . . . lightweight (38 lbs.) but pumps more water than any other comparable unit . . . 32 g.p.m. at 80 p.s.i. to 6 g.p.m. at 275 p.s.i.



PACIFIC "PACOLIZED" HOSE
—the best lightweight hose you can buy for portable or emergency water supply . . . permanently mildew proof and rot resistant . . . the most flexible hose of its type.

Specify "Pacific" Pumpers, Hose and accessories. Write for information on the "Y", "5-A" and the full line of Pacific fire equipment, perfected for portability and high performance.

PACIFIC *Marine Supply Co.*
FIRE EQUIPMENT DIVISION
SEATTLE 1, WASHINGTON

Students Eligible for Automatic Advancement

PENNSYLVANIA STATE UNIVERSITY

Bell, R. W.	Johnson, A. L.
Bimber, G. E.	Johnson, D. W.
Biser, D. B.	Loucks, D. P.
Cobi, R. A.	Mitchell, H. H.
Craul, J. P.	Peters, T. E.
Cupka, L. J.	Roberts, J. P.
Dyke, S. H.	Sell, C.
Eckert, P. L.	Thomas, R. J.
Holm, D. S.	Umholtz, F. A.
	Wiles, F. L.

WEST VIRGINIA UNIVERSITY

Dixon, J. R.	Ulrich, J. A.
McCutcheon, H. D.	White, E. C.
Rinehart, G. C.	Wiant, H. V.
Roy, G. K.	

Appalachian Section

Student Grade

DUKE UNIVERSITY

Bilan, M. V.

Junior Grade

Sutton, R. F., Forester, Flack-Jones Lbr. Co., Inc., Moncks Corner, S. C.; Duke, M.F., 1949.

Students Eligible for Automatic Advancement

DUKE UNIVERSITY

Crockett, J. M.	Martin, C. E.
Gross, D. F.	Stillwell, H. D.
Kelly, G. L.	Turner, R. G.

NORTH CAROLINA STATE COLLEGE

Andersen, H. J.	Groves, F. R.
Barron, J. S.	Holmes, M. L.
Barrett, J. P.	Nicholson, J. E.
Bideaux, R. O.	Payne, B. B.
Biggert, J. C.	Raper, C. R.
Derro, J. J.	Sewell, C. S.
Dutka, O. J.	Wells, J. J.
Gallup, L. E.	White, B. B.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Lund, A. E.	Zipse, R. E.

Junior Grade

Students Eligible for Automatic Advancement

COLORADO A & M COLLEGE

Allison, C. T.	Miller, D. L.
Andresen, P. R.	Moore, J. E.
Betts, R. E.	Pitcher, K. A.
Boldt, C. F.	Powell, H. D.
Bossi, J. E.	Reichle, R. E.
Davis, J. R.	Rhoads, R. E.
Faught, T. L.	Robison, D. L.
Fenner, W. M.	Sacks-hewsky, M. L.
Gallagher, D. G.	Schamberger, J. E.
Garrison, V. L.	Simon, C. L.
Hartsaw, D. R.	Wingerter, H. T.
Larson, M. M.	Zimmermann, G. P.

Central States Section

Student Grade

UNIVERSITY OF MICHIGAN

Burfiend, G. H.	Montgomery, W. J.
Dalton, C. B.	Myers, E. A.
McElfresh, W. A.	

Junior Grade

Burton, J. E., Highway Forester, Mich. State Highway Dept., Alpena, Mich.; Mich. State, B.S.F., 1949.

Coon, E. T., Sales Representative, Dow Chemical Co., Midland, Mich.; Mich. State, B.S.F., 1948.

Students Eligible for Automatic Advancement

MICHIGAN STATE COLLEGE

Dyment, R. R.	Rugg, R. F.
Falasky, E. V.	Siegel, W. C.
Hayden, D. A.	Tubbs, C. H.
Hubbell, R. J.	Voice, J. D.
Jones, J. R.	Williams, J. G.
Pfeiffer, C. A.	

UNIVERSITY OF MICHIGAN

Cowan, D. R.	Libby, W. J.
Geertsema, G. L.	McArdle, J. P.
Grow, T. R.	Peterson, R. W.
Harpfer, H. E	Smock, S. N.
Hoglund, N. O.	Zandersons, O. G.

PURDUE UNIVERSITY

Beall, F. R.	Mathison, T. E.
Biddle, G. H.	Munier, P. L.
Blann, E. B.	Murray, J. R.
Boles, M. E.	Siegworth, H. D.
Burns, J. T.	Stanger, L. O.
Doub, R. L.	Zurbriggen, D. J.
Gorrell, J. W.	

Columbia River Section

Junior Grade

Bergman, M. H., Asst. Forester, Willamette Valley Lbr. Co., Dallas, Ore.; Univ. of Wash., B.S.F., 1950.

Driscoll, R. S., Range Aide, U.S.F.S., Portland, Ore; Colo. A & M, B.S.F., 1951.

Fruits, G. W., Inspector, Ore. State Board of Forestry, Roseburg, Ore.; Oregon State, B.S.F., 1951.

Kischel, R. E., County Forester, Douglas County Land Dept., Roseburg, Ore.; Oregon State, B.S.F., 1948. Reinstatement.

Gulf States Section

Junior Grade

Greene, J. H., Asst. Dist. Forester, La. Forestry Comm., Natchitoches, La.; L.S.U., B.S.F., 1951.

Nutter, O. H., Technician, International Paper Co., Canton, Miss.; W. Va. Univ., B.S.F., 1952.

Students Eligible for Automatic Advancement

LOUISIANA STATE UNIVERSITY

Brister, J. C.	McKay, M. K.
Craft, H. W.	Merrill, T. H.
Givens, T. E.	Myers, J. C.
Graham, J. R.	Parker, R. L.
Jackson, W. B.	Remel, J.
Kornman, W. M.	Richard, W. E.
Logan, R. D.	Spear, R. W.
Marshall, R. B.	Van Dine, D. G.
Martin, R. B.	

Member Grade

Smith, M. R., Box 657, Olla, La.; La. State, B.S.F., 1937. Reinstatement.

Thomas, L. H., Dist. Forester, Gaylord Container Corp., Walker, La.; Iowa State, B.S.F., 1947. (Junior, 1948).

Affiliate Grade

Crowe, W. M., Head Scaler, La. & Bastrop Mills, Bastrop, La.; L.P.I., B.S., (Forestry), 1949.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Klason, R. P.

Junior Grade

Students Eligible for Automatic Advancement

UNIVERSITY OF IDAHO

Andraitis, A. A.	McManamon, D. R.
Brookwell, W. T.	Menges, P. E.
Curtis, A. B.	Ohs, C. A.
Harberd, J. W.	Parker, R. D.
Hollett, G. K.	Plymale, G. V.
Jepsen, S. M.	Riecken, H. W.
Johnson, L. C.	Smith, L. O.
Lindstrom, T. C.	Stolass, H. L.
Matzner, F. T	Tagawa, T. K.

Member Grade

Dion, C. R., Highway Engineer, State of Wash. Highway Dept., Spokane, Wash. (Junior, 39R53).

Gibson, A. L., Forest Ento., U.S.F.S., Coeur d'Alene, Idaho. (Junior, 45R53).

Lamoreaux, H. G., Timber Buyer, Lincolin Lbr. Co., Inchelium, Wash. (Junior, 1945).

Trosper, T. H., Forester, U.S.F.S., Orofino, Idaho. (Junior, 1947).

Intermountain Section

Junior Grade

Students Eligible for Automatic Advancement

UTAH STATE AGRICULTURAL COLLEGE

Alfano, S. S.	Hudson, R. H.
Christensen, R. C.	Johnson, J. H.
Fenton, B. W.	Niskala, G. R.
Haines, W. H.	Sawyer, R. H.
Hoffmann, J. A.	

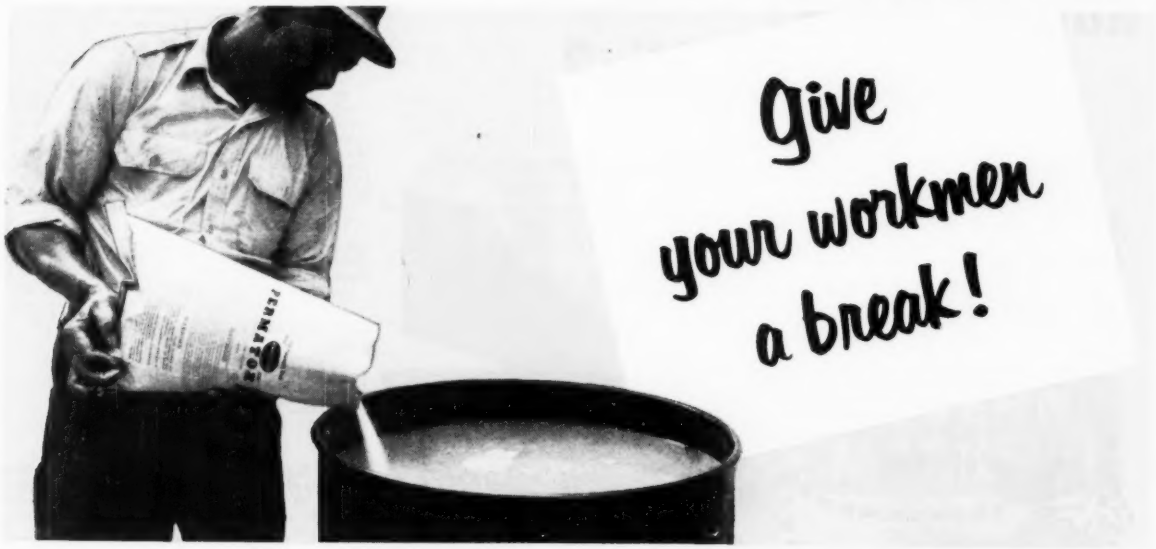
New England Section

Junior Grade

Clifford, R. E., Woods Supt., Great Northern Paper Co., Bangor, Maine; Univ. of Maine, B.S.F., 1938. Reinstatement.

Koenig, W. L., Chief Forester, New England Forest Ind., Inc., Concord, N. H.; Duke Univ., M.F., 1949. Reinstatement.

USERS OF SAP STAIN CONTROL CHEMICALS:



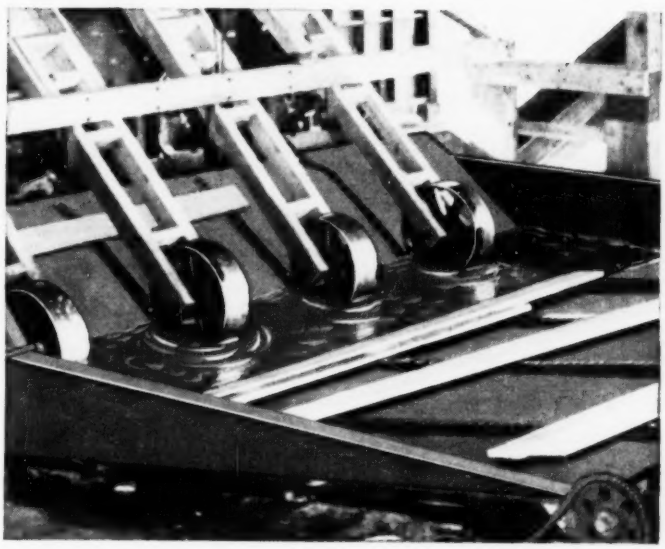
No irritating dust problem with Permatox 10-S

New ingredient makes Permatox 10-S easier to handle and mix than ever before

Since 1933 Chapman has conducted continuous research to improve sap stain chemicals and methods of application. The newest Chapman research development in this field makes Permatox 10-S practically dust-free by the addition of a new ingredient to this tried-and-proven formula.

There is no increase in price for this improved Permatox 10-S.

Permatox 10-S prevents *both* sap stain and mold in hardwoods and softwoods. Mixed with Chapman Ambrocide, it also protects lumber against damaging attacks by ambrosia beetles and other insects.



CHAPMAN CHEMICAL COMPANY

Dermon Bldg., Memphis 3, Tenn.
Terminal Sales Building, Portland 5, Ore.

Write For Free Bulletin on Stain and Insect Control

CHAPMAN®

PERMATOX 10-S

Prevents *both* sap stain and mold, in freshly cut hardwoods *and* softwoods

Rather Mark? . . . or Mix?

SOUTHERN GLO
stay-mixed formula

Ready-Mixed Means Ready to Use

If you accept stirring as necessary to prepare paint for use . . . if you must thin your ready-mix to make it perform satisfactorily in your spray gun . . . you're not getting all the time and labor savings you're entitled to from your Ready-Mixed tree marking paint.

The stay-mixed Southern Glo formula produces a Ready-Mix that requires no stirring. And its consistency is right for use in your gun! No thinning,—no stirring.—Just open, pour and spray!

To make it easier to carry, Southern Glo Ready-Mix is packed in a flat, small-opening can from which you pour directly into the gun . . . eliminates need for carrying a funnel in your pack.—Or if you prefer, you may get it in the conventional round container. Yellow, white, blue, red, orange.

At your dealers or write

SOUTHERN COATINGS & CHEMICAL CO.
Dept. H-2, Sumter, South Carolina

SOUTHERN GLO FORMULA #71020 IS ALSO AVAILABLE IN PASTE. A DOUBLE ECONOMY FOR VOLUME USERS.—AND SOUTHERN GLO BOUNDARY PAINT.

Students Eligible for Automatic Advancement

UNIVERSITY OF MAINE

Atkinson, O. R.	Smith, R. S.
Broshkevitch, J. B.	Vanidestine, W. F.
Brubaker, R. G.	Weiland, G. W.
McGowen, N. W.	

UNIVERSITY OF MASSACHUSETTS

Arsenault, R. D.	Lincoln, A. C.
Decelle, P. A.	Knapp, H. A.
Doe, A. P.	Nason, B. W.
Dort, C. W.	Pywell, R. E.
Greenberg, S.	Ripley, W.
Galloway, F. L.	Weston, K. G.
Houston, D. R.	White, E. F.

YALE UNIVERSITY

Craig, J. N.	Tessier, J. P.
Echols, R. M.	Westing, A. H.
Spencer, H. G.	

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Harding, A. J. R.	Schultz, D. A.
Luche, T. C.	Schultz, R. J.
McKenzie, T. A.	Tremper, E. O.
Pratt, F. D.	Valantine, M. F.

Junior Grade

Miller, H. C., Extension Ento. & Path., State Univ. of N. Y., Syracuse, N. Y.; State Univ. of N. Y., B.S.F., 1941; Cornell Univ. Ph.D. 1951.

Students Eligible for Automatic Advancement

STATE UNIVERSITY OF NEW YORK

Ashley, A. N.	Sears, G.
Craine, J. R.	Stevens, P. A.
Cronk, A. G.	Trainer, F. M.
Fessel, W. C.	Wingle, H. P.
Marks, R. J.	Zelsnack, F. T.
Mook, D. G.	

Affiliate Grade

Heasman, G. E., Woods Safety Supervisor, Pembroke Shook Mills, Pembroke, Canada; Univ. of Toronto, B.S., (Forestry), 1953.

Associate Grade

Reid, K. A., Supt. of Nat. Res., Whitney Industries, Sabattis, N. Y.; Yale Univ., Ph.D., 1917.

Northern California Section

Junior Grade

Students Eligible for Automatic Advancement

UNIVERSITY OF CALIFORNIA

Bedow, R. J.	Nelson, T. W.
Binninger, D. L.	Peakes, W. C.
Burton, L. R.	Rotto, M. A.
Caster, P. B.	Schwarz, H. C.
Davies, G. R.	Shideler, E. A.
Hoerr, R. C.	Webber, H. M.
Laursen, V. R.	Zaerr, J. B.
Lavell, R. M.	

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Graham, D. A.

Junior Grade

DeLaMartre, R. R., Forester, U.S.F.S., Libby, Mont.; Univ. of Minn., B.S.F., 1951.
Kasberg, W., Highway Design Engineer, U.S. F.S., Butte, Mont.; Mont. State, B.S.F., 1951.
McAvoy, R. T., Forestry Aide, U.S.F.S., Libby, Mont.; Mont. State, B.S.F., 1948.
Milodragovich, J. R., Forester, U.S.F.S., Libby, Mont.; Mont. State, B.S.F., 1941.
VanDenburg, D. O., Forester, U.S.F.S., Libby, Mont.; Penn. State, B.S.F., 1951.

Member Grade

Castles, J. R., Reg. Logging Engineer, U.S. F.S., Missoula, Mont. (Junior, 1947).
Dillard, A. H., Dist. Ranger, U.S.F.S., Kalispell, Mont (Junior, 1947).
Friedrich, C. A., Forester, U.S.F.S., Missoula, Mont. (Junior, 1947).
Gardner, R. C., Dist. Ranger, U.S.F.S., Kalispell, Mont. (Junior, 1946).
Harris, H. K., Forester, U.S.F.S., Missoula, Mont. (Junior, 1946).

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Lowery, J. W. Sackett, A. H.

Junior Grade

Fisher, H. R., Forester, U.S.F.S., Hot Springs, Ark.; Penn State, B.S.F., 1953.
Gilligan, J. P., Asst. Prof., Okla. A & M, Stillwater, Okla.; Univ. of Mich., B.S.F., 1940; M.F., 1949; Ph.D., 1954.

Students Eligible for Automatic Advancement

UNIVERSITY OF MISSOURI

Cornell, B. M. Hubbs, O. W.
Cowley, A. P. Ross, R. D.
Gass, R. D. Scharpf, R. F.
Hepting, W. C.

Affiliate Grade

Watts, B. E., Asst. Dist. Forester, Dierks Lbr. & Coal Co., Broken Bow, Okla.; Okla. A & M, B. S., (Forestry), 1953.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Stephens, F. R.

Junior Grade

Lewis, H. B., Engr., Weyerhaeuser Tbr. Co., Vail, Wash.; Univ. of Wash., B.S.F., 1952.
Limatta, I. M., Asst. Logging Engr., Ketchikan Pulp Co., Ketchikan, Alaska; Colo. A & M., B.S.F., 1951; Univ. of Wash., M.F., 1953.
Pike, C. C., 7013½ Linden Ave., Seattle, Wash.; W. Va. Univ., B.S.F., 1950. Reinstatement.

Students Eligible for Automatic Advancement

UNIVERSITY OF WASHINGTON

Beckwith, W. K. Nilson, A. E.
Burks, M. J. Olson, L. W.
Campbell, H. G. Polley, G. J.
DeZarn, D. D. Radnich, J. C.
Eells, C. M. Schuler, D. E.
Grove, B. F. Villager, H. A.
Joyce, R. L. Waaga, A. T.
Koenig, R. C. Ward, W. B.
Larson, R. O. Wilbur, D. W.
Murdock, W. G. Wilson, G. H.

Member Grade

Lee, O. A., Asst. Mgr., Kosmos Div., U. S. Plywood Corp., Kosmos, Wash.; Univ. of Wash., B.S.F., 1942. (Junior, 1948).

Affiliate Grade

Gifford, G. H., Tbr. Mgmt. Asst., U.S.F.S., Quilcene, Wash.
Gronberg, E. A., Engr. Aide & Inspector, Wash. Dept. of Highways, Aberdeen, Wash.
Ray, J. W., Tbr. Mgmt. Asst., U.S.F.S., Vancouver, Wash.
Wright, F. R., Dist. Forest Warden, State Div. of Forestry, Shelton, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF GEORGIA

Atchison, F. D. Thompson, L. O.

Junior Grade

Cannon, A. P., Project Forester, U.S.F.S., Hillsboro, Ga.; Univ. of Ga., B.S.F., 1949.
Ellis, H. W., Forester, Fla. Forest Service, Lakeland, Fla.; Univ. of Fla., B.S.F., 1949.
Harling, R. M., Cons. Specialist, International Paper Co, Gainesville, Fla.; Univ. of Ga., B.S.F., 1949.
Jones, R. A., Forest Tech., International Paper Co., Panama City, Fla.; Univ. of Mich., B.S.F., 1951; M.F., 1951. Reinstatement.
Poole, J. W., Field Asst., International Paper Co., Panama City, Fla.; Univ. of Fla., B.S.F., 1950. Reinstatement.
Sosbe, E. H., Area Mgr., North Ga. Timberland Co., Rome, Ga; Purdue, B.S.F., 1949; M.F., 1952. Reinstatement.

Students Eligible for Automatic Advancement

ALABAMA POLYTECHNIC INSTITUTE

Rice, J. T. Williams, M. D.
Toler, B. G.

UNIVERSITY OF FLORIDA

Brock, G. A. Snell, G. F.
Lindau, A. H. Thompson, L. T.
Lunday, A. N.

UNIVERSITY OF GEORGIA

Baker, W. A. Jones, E. P.
Cole, R. S. Marshall, C. M.
Dennis, A. C. Rue, A. J.
Haeussler, F. W. Thomas, W. P.
Hellams, R. B. Watts, G. M.
Herndon, A. J. Williams, M. F.
Hill, J. C.

Member Grade

Clifton, F. H., Private Forester, 1408 N. Boulepard, Deland, Fla.; Yale Univ., M.F., 1948. (Junior, 1948).

Southern California Section

Member Grade

Ball, R. J., Teacher, John Muir College, Pasadena, Calif. (Junior, 1946).
O'Neal, N. C., Forester, U.S.F.S., Santa Barbara, Calif. (Junior, 1947).

Southwestern Section

Junior Grade

Pfilf, R. J., Box 466, Tucson, Ariz.; Univ. of Idaho, B.S.F., 1953.

Upper Mississippi Valley Section

Junior Grade

Students Eligible for Automatic Advancement

IOWA STATE COLLEGE

Corrigan, C. H. Miller, C. W.
Griswold, R. K. Paakkonen, O. E.
Haaland, C. J. Parker, D. F.
Homan, K. A. Rawley, J. E.
Lamansky, W. H. Renaud, R. E.
Lassen, L. E. Schallau, C. H.
MacPeak, M. D.

UNIVERSITY OF MINNESOTA

Anderson, N. C. Kerrick, M. A.
Crawford, D. W. King, D. A.
Froelich, R. C. Nepp, J. F.
Haney, R. C. Rhondes, H. E.
Johnson, R. G. Schramek, R. W.

Washington Section

Junior Grade

Darrow, C. E., Mgmt. Trainee, Kern Distributing Co., Arlington, Va.; State Univ. of N. Y., B.S.F., 1951.

MARK of the MODERN TREE MARKER!

ALL 3 IN ONE

A GUN THAT CLEANS ITSELF!

—with a reversible nozzle that saves hours of dirty work. Whenever the gun plugs, just turn the nozzle around and pull the trigger!

—And with a protective cap for the nozzle to prevent paint from hardening inside the gun and keep dirt out when gun is not in use. Has a cleaning wire fixed in the cap too, to ramrod the orifice clear. (Note holder for cap when gun is in use).

A CAN THAT SCREWS ON THE GUN!

so that you don't need to carry messy funnels and canteens, or waste time transferring paint in the woods. Just screw on a new quart of Nelson paint, throw away old cans as fast as used up!

A PAINT YOU DON'T HAVE TO STIR!

because it contains additives which prevent it from settling, thickening or skinning over even in a half empty can! Durable too, not absorbed into wood or bark, and retains high visibility over long periods. Bright yellow, white, orange, blue, red, 5 colors to choose from.

NO MORE OF THIS!

NO MESSY FUNNELS, CANTEENS

— AND PAYS FOR ITSELF!

Try it, as foresters all over the world have! Order one gun or a dozen—one case of Nelson's specially compounded tree-marking paint or enough for all your marking needs. This revolutionary new 3-way money-saver pays for itself in days!

TRY IT!

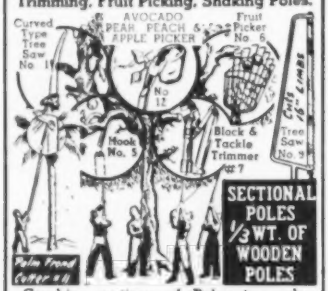
THE NELSON COMPANY
1234 Prospect Avenue
Iron Mountain, Michigan

FOREST METEOROLOGIST
Fire Danger Rating . . . Weather Instruments
Sales and Service . . . Weather Modification
Research . . . Forecasts and Advisories
J. B. "Ben" MELIN
2806 32nd Ave. S. Seattle 44, Wash.
Telephone RA inier 0356

REFORESTATOR
Mechanical Tree Planter

Manufactured by
L. W. MERIAM CO.
Elsie, Michigan

For over ten years
a dependable source
for
Southern Pine Seed
SOUTHERN SEED COMPANY INC.
Baldwin, Georgia

DON'T BREAK YOUR NECK! PREVENT ACCIDENTS!
Prune the Tallest Tree While Standing Safely on the Ground
CUT LABOR COSTS 'n 50%
DOUBLE PRODUCTION! With the New, Amazing, LIGHTWEIGHT ALUMINUM Comb, Sawing, Pruning, Trimming, Fruit Picking, Shaking Poles.

Curved Type Tree Saw No. 11
AVOCADO PEAR PEACH & APPLE PICKER No. 12
Fruit Picker No. 6
Cuts Limbs
Hook No. 5
Block & Tackle Trimmer No. 7
Tree Saw No. 9
SECTIONAL POLES 1/3 WT. OF WOODEN POLES
Palm Frond Cutter No. 10
Combine sections of Poles to make Poles up to 90 ft. tall. Weighs 1 lb. per 5 ft. 70c per ft. Attachments extra. No breakage. No splinters. Lasts forever. Send for FREE CATALOG & FREE BOOKLET
HOW TO PRUNE FRUIT & SHADE TREES
J.B.J. Schroll CORP.
300-S. Los Angeles St.
Los Angeles 13, Calif. - MA. 6-9397

Forestry News

Council on Research and Education in South Formed

Representatives of industry, government, and education met in Atlanta on May 12 to organize the Council on Forestry Research and Education in the southern state. The Council, established under the auspices of the Southern Regional Education Board, was recommended by a 1952 meeting of representatives of the accredited southern forestry schools, lumber and pulp-producing industries, state and federal forestry agencies, and the Society of American Foresters.

E. J. Gaynor, president of the Brunswick Pulp and Paper Company, was elected as first chairman of the Council. Vice chairman in Charles A. Connaughton, regional forester of the U. S. Forest Service, and secretary is Wm. J. McGlothlin, consultant for professional programs of the Southern Regional Education Board.

The purpose of the Council is to discover, recommend, and work toward establishing more effective ways by which the various groups represented may work together in training more foresters and undertaking broadened research to meet the needs of wood producers and users in the South.

As one of its initial activities the Council will undertake to secure support for regional fellowships and scholarships in forestry, in an effort to step up recruitment of able and qualified students in both undergraduate and graduate schools of forestry in the South.

The Council will also undertake a study of research in progress in schools, industry, and governmental agencies in an effort to determine where additional research should be undertaken and coordinated for maximum benefit to forestry education and industries.

Other members of the Council are: F. H. Claridge, state forester, Raleigh, N. C., representing Southern Group, State Foresters Association; Adrian P. Downing, executive vice president, T. R. Miller Mill Co., Brewton Ala.; Wilbur DeVall, dean, Department of Forestry, Alabama Polytechnic Institute, representing Regional Committee on Forestry Education and Research; L. J. Heatherly, secretary-manager, Southern Hardwood Producers, Inc., Memphis, Tenn., representing Southern Hardwood Producers; Erling Riis, vice president, Southern Kraft Division, International Paper Co., Mobile, Ala., representing American Paper and Pulp Association; A. R. Shirley, secretary, American Turpentine Farmers Association, Valdosta, Ga., representing American Turpentine Farmers Association; D. J. Weddell, dean, School of Forestry, University of Georgia, representing Regional Committee on Forestry Education and Research; Vertress Young, executive vice president, Gaylord Container Corp., Bogalusa, La., representing American Paper and Pulp Association.

The Council will also request representation from the American Wood Preserving Association and the Forest Farmers Association.

Government

Rocky Mountain Regional Office Reorganized

Reorganization resulting in elimination of one assistant regional forester division head position, as well as two other lower grade positions in the Denver regional office of the U. S. Forest Service, has been announced.

The Division of Personnel Management will be consolidated with the Division of Operation into a new Division of Administrative Management, according to Regional Forester D. E. Clark. David S. Nordwall, present head of the Division of Recreation, Lands, and Watershed Management, will head the new division following M. W. Thompson, who is retiring as head of the Division of Operation. Nordwall will be assisted by Carlos T. Brown, formerly assistant head of Personnel Management and Andrew Hutton, present assistant head of Operation.

Russel McKennan, present head of the Division of Personnel Management, which is being consolidated, will shift to head of the Division of Recreation, Lands, and Watershed Management. Assistant head of this division will be Clarence Thornock, previously supervisor of the Grand Mesa National Forest, which has been consolidated with three other forests. Jack McNutt, presently a member of this division, will be assigned to the position recently vacated through retirement of Lee Kirby, responsible for watershed management. "McNutt will also be

IMPROVE YOUR TIMBER STAND

BY KILLING UNDESIRABLE TREES & LET GOOD PINE & HARDWOOD GROW

METHODS OF USING

For ECONOMICAL & EFFECTIVE timber stand improvement work use WEEDONE 2,4,5-T in simple frills. Our field tests show that a mixture of 1 gal. to 50 gal. of water is sufficient for any species.

WEEDONE 2,4,5-T can also be used as a basal spray, stump treatment or foliage application.

Made by American Chemical Paint Co., originators of 2,4-D & 2,4,5-T Weedkillers. Distributed by FORESTRY SUPPLIERS, INC.

Frill girdle-cut through bark into wood. Solution poured in girdle - fill cuts with solution
Cut V notch-Wet notch and top of stump thoroughly

WEEDONE 2,4,5-T is non-toxic and non-corrosive. Easy to mix and handle. Available in 1 gal. can, 5 gal. can, 30 gal. drum and 54 gal. drum.

USE WEEDONE

Results are more consistent with WEEDONE 2,4,5-T. Resprouting is almost non-existent. Increase growth on good trees by removing undesirables.

We are sure that you will be pleased with the results obtained from the use of this product. Write for free literature.

Contact Us For Your Forestry Supplies

No matter what your needs may be—you can get exactly what you want from . . .

FORESTRY SUPPLIERS INC.

132 RAYMOND ROAD
JACKSON, MISSISSIPPI

responsible for other broad phases of land management and recreation planning," Clark said.

Fire Control, previously in the Division of Operation, will be combined with Information in a Division of Information and Fire Control, headed by J. N. Hessel. Assistant head of this division will be Roy L. Williams.

Roy L. Weeman, presently in charge of the section of communications, will be transferred to Missoula, Mont., and responsibilities of this section shifted to the Division of Engineering. His position in the regional office will not be filled. "Communications, which are closely related to Fire Control, are no less important," Clark said, "but there is a much bigger communications job in the Montana-Idaho Region than here in the Rocky Mountain Region, and budget reductions make this change necessary in the interest of economy."

William K. Nelson, previously with the Portland, Ore., regional office, Division of Engineering, and presently on military leave in Europe with NATO headquarters in Paris, will replace A. E. Kyffin, deceased, as chief of the Section of Water Power and Hydraulics in the Division of Engineering. He will assume communications responsibilities previously assigned to Weeman.

C. A. MacMackin, recreation planner, will be transferred to the Pike National Forest.

Warren Tracy, in charge of personnel classification and safety, will transfer from Denver to the Arapaho National Forest.

Byron Beattie Becomes Fire Control Assistant Chief

Byron B. Beattie, supervisor of the Sierra National Forest, California, has been appointed as assistant to the chief of fire control of the Forest Service with headquarters in Washington, D. C. The effective date of Beattie's promotion was May 9.

A native Californian and graduate of the University of California, Beattie began his career as a public forester in 1935. He served on five of the national forests in California and as a regional staff officer in San Francisco prior to his assignment as forest supervisor of the Sierra National Forest in 1948.

Royal Scottish Forestry Society

The Royal Scottish Forestry Society was founded in 1854, one hundred years ago, yet professional growers of young trees had been well established for at least a century before that date. Among the first records of the production of young trees for sale are those of Robert Dickson, who began a nursery at Hassendeanburn, near Hawick, in 1729. In 1755 a branch of this business was established in Edinburgh and large nurseries were carried on for a hundred and twenty-five years but eventually had to be moved, owing to the growth of the city. Many famous foresters and gardeners were trained in these nurseries, among them J. C. Loudon, whose "Hortus Britannicus" is still regarded as a standard work.

—From "The Forest Nursery Trade in Scotland," *Scottish Forestry*, April 1954.

INCREMENT HAMMERS

MADE IN
MORA, SWEDEN

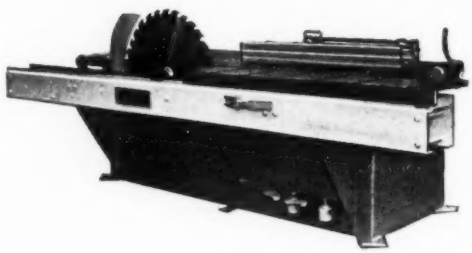
- Accurate
- Fast
- Sturdy
- Weighs 13 oz.
- 10" long

Designed for quick, easy examination of bark and recent tree growth. Use like a hammer and extract ¾" core *instantly*. A time-saver in selective cutting operations. Your free copy of our Forester's Tool Catalog is yours for the asking.

Write Dept. J.

SANDVIK SAW & TOOL
DIVISION OF SANDVIK STEEL, INC.
47 WARREN STREET NEW YORK 7, N. Y.

SHORT LOG BOLTER



Ricker Series 1000

A modern self-contained mill. Developed for the purpose of salvaging small logs, slabs and edgings.

"Built By Lumbermen For Lumbermen"

DIMENSION
MILL EQUIPMENT CO.

Deansboro, New York

J. A. Beale Named Wisconsin State Forester

John Allen Beale of Wisconsin Rapids, Wis., has been appointed state forester of the Wisconsin Conservation Department. He is the first individual to bear that title since 1915 and will head up the three forestry divisions of the department. He succeeds C. L. (Neil) Harrington, acting state forester since November 1952, who will retain his position as superintendent of state parks and forests. Prior to 1952, forestry work was headed by the department director, then Ernest Swift, who is now with the U. S. Fish and Wildlife Service. In his new position Beale will also hold the title of assistant conservation director.

Beale, 35, is a 1940 forestry graduate of Michigan State College. He served in the Army from 1941 to 1945, being discharged as a Captain in the 1st. Armored Division. He was wounded after having engaged in the African campaign and the action at Anzio Beach and Rapido River.

Beale joined the state's Conservation Department in 1945 and has held various forestry positions, most recently, while at Wisconsin Rapids, in charge of county forestry work for the Cooperative Forestry Division.

At the time of his appointment Beale was attending Harvard University, working toward a Master's degree in public administration.

JOHN A. BEALE

G. H. Hepting Honored by U.S.D.A.

George H. Hepting of the Southeastern Forest Experiment Station, U. S. Forest Service, received an award May 18 from the Department of Agriculture for his superior service in forest pathology. He directs the tree-disease research program at six field laboratories in the southern states and has been with USDA since 1926. The awards for unusual service were made to a total of 93 USDA employees by Secretary Ezra T. Benson, following an address by Vice President Nixon.

Outstanding accomplishments by Hepting and his Division of Forest Disease Investigations include: discovery of a new pine rust; determination of the cause of serious wilts of sugar maple and mimosa; discovery and development of a strain of wilt-resistant mimosa; determination of methods for avoiding butt rot in sprout oak stands; relation of the littleleaf disease of shortleaf pine to nitrogen supply, carbohydrate production, soil permeability, and Phytophthora killing of rootlets; determination of soil types on which pine can be grown without loss from littleleaf; demonstration of control of oak leaf blister by dormant sprays; and recognition of *Fusarium lateritium* f. *pini*, which stimulates gum flow from Virginia pine. His division has done important work on oak wilt in the Appalachians, correcting decay conditions in wooden trainer planes and gliders during the war, and later correcting decay conditions in wooden Naval vessels.

In addition to his work for the Forest Service, Hepting, as an authority on forest pathology, advises the TVA, SCS, state foresters, state experiment stations, the National Park Service, pulp and lumber companies, municipalities, and the forestry and pathology departments of universities.

He is at present very active in disease aspects of the national Timber Resources Review. Author of some 80

G. H. HEPTING

Outstanding McGRAW-HILL BOOKS

WOOD PRESERVATION
New 2nd Edition

By GEORGE M. HUNT, U. S. Forest Products Laboratory, Madison, Wisconsin; and GEORGE A. GARRATT, Yale University. *American Forestry Series.* 405 pages, $7.50

Covers the entire field of wood preservation, including the natural durability and treatability of different woods; descriptions of the important fungi and insects that destroy wood in storage and use; descriptions of the more common wood preservatives and of methods of evaluating preservatives; equipment and operation of treating plants; and the economic aspects of wood preservation.

WILDLIFE MANAGEMENT: Upland Game and General Principles — Volume I

By REUBEN E. TRIPPENSEE, University of Massachusetts. *American Forestry Series.* 479 pages, $6.00

Here is a simple, direct, quantitative approach to the process of making the land produce sustained crops of wild animals. The book gives a summary of the life histories of important game animals of North America, with techniques for their management. It also discusses the farm, the forest, and wilderness conditions as these relate to wild animals, and suggests ways whereby the land manager can make his holdings tenable for occupancy by wild animals.

WILDLIFE MANAGEMENT: Fur Bearers, Waterfowl and Fish — Volume II

By REUBEN E. TRIPPENSEE. *American Forestry Series.* 552 pages, $7.50

This second and final volume of the authoritative study concisely brings together pertinent facts on management of water and wet lands; life histories, ecology, and management of fur bearing animals, waterfowl, and freshwater game fish, and presents necessary procedures for their abundant production and orderly harvest. Descriptions of their habitats are also included. Outstanding illustrations show points of both beauty and interest.

Send for copies on approval

McGRAW-HILL BOOK CO., Inc.

330 West 42nd St., N. Y. 36, N. Y.

scientific publications, he is past president of the Southern Shade Tree Conference, a member of the American Phytopathological Society, National Shade Tree Conference, and Sigma Xi. He has served on the editorial board of the JOURNAL OF FORESTRY.

U.S.D.A. Awards to H. D. Cochran and C. B. Stott

H. Dean Cochran and Calvin B. Stott, both of the U. S. Forest Service, Milwaukee, Wisconsin, were presented with Superior Service Awards by Secretary of Agriculture Ezra Taft Benson in Washington, D. C., on May 18.

H. DEAN COCHRAN

CALVIN B. STOTT

These awards were part of special ceremonies honoring 91 men and women and work units for outstanding achievements, from all over the country, all of the Department of Agriculture. Nine were winners of Distinguished Service Awards, 84 employees and 13 work units received Superior Service Awards, and 51 workers were presented with special Length of Service awards for 40 or more years' service. Vice President Richard M. Nixon delivered the address and Assistant Secretary of Agriculture J. Earl Coke presided at the ceremonies.

Mr. Cochran, now regional forester for the North Central Region of the U. S. Forest Service, was given his Superior Service Award for his activities as chief of the Division of

Consulting Foresters

Professional Services Offered by
Members of the Society of American Foresters

WILLIAM A. EASTMAN, JR.
Consulting Forester
Complete Professional Service
SEATTLE 1, WASHINGTON
410 J. GREEN BUILDING
'Phone SEneca 2814

ALBERT G. HALL
Forestry Relations Counsel
Consulting Forester
1740 K Street, N.W., Washington 6, D. C.

POND & MOYER CO., INC.
Consulting Foresters
Estimates—Appraisals—Surveys
Machine Tree Planting Service
107 HOMESTEAD RD., ITHACA, N. Y.

FOREST PROPERTY
Estimates—Appraisals—Management
Prentiss & Carlisle Co., Inc.
107 Court Street Bangor, Maine

TIMBERLAND MANAGEMENT, INVENTORY AND APPRAISAL
—OVER 50 MILLION ACRES SINCE 1910
JAMES W. SEWALL COMPANY
FOREST ENGINEERS
OLD TOWN, MAINE
BRANCH: JAMES W. SEWALL CO. (CANADA) LTD., FREDERICTON, NEW BRUNSWICK

GEORGE BANZHAF & COMPANY
622 North Water Street MILWAUKEE 2 BRoadway 6-2062
Consultants to the Forest Industries

C. D. SCHULTZ & COMPANY
Foresters and Engineers
WM. H. PRICE, Manager
344 Henry Building
Seattle 1, Washington
325 HOWE STREET
VANCOUVER 1, CANADA

FOREST APPRAISALS FOREST TAXATION
GROWTH AND MANAGEMENT PLANS
FRANK J. LEMIEUX
Consulting Forester
25 Years' Experience in North and South America
833 WHITNEY BLDG., NEW ORLEANS 12, LA.

Reforestation Arboriculture
S. GAYLEY ATKINSON
Consulting Forester
Huntingdon Road
Huntingdon Valley, Pa.

Personnel Management in Washington between 1942 and 1953. Before that, he served in various capacities in the Rocky Mountain Region. He received his A. B. degree from Illinois College in 1918, his B. S. degree in forestry from Colorado Agricultural College in 1920, and an honorary doctor of science degree from the latter in 1945. His citation reads "For notable accomplishments in the field of human relations, and for vision and leadership in developing the Forest Service personnel program."

Mr. Stott has been connected with the Division of State and Private Forestry Cooperation in the North Central Region of the Forest Service since 1934. He obtained his B. F. degree from Pennsylvania State Forest School in 1919 and his M. F. from Yale in 1925. He became a ranger for the Forest Service in Minnesota in 1925 and served as assistant forest supervisor on the Superior National Forest between 1930 and 1934. His citation reads "for initiative and leadership in adapting improved techniques in getting industry and the states to improve forest management on their lands."

M. W. THOMPSON

M. W. Thompson Retires

Myron W. Thompson, assistant regional forester in charge of administrative management and fire control for the Rocky Mountain Region of the U. S. Forest Service, retired June 30.

First appointed as a forest assistant on the Shoshone National Forest in Wyoming, in 1911, Thompson completed 43 full years of active duty. He received a B.S. degree in Agriculture from Massachusetts State College and a Master's degree in Forestry from Yale University. Thompson served as forest examiner on four national forests prior to joining the regional forester's staff in Denver, in 1915. In August 1920, he was appointed assistant regional forester in charge of timber management and retained this position until July 1935, when he shifted to his present position in charge of administrative management and fire control.

Commenting on the retirement, Regional Forester Donald E. Clark stated that Thompson is one of the relatively few remaining members of the small group of trained foresters who built the Forest Service organization and made it one of the leading forces for conservation in the nation. "Thompson's contributions to timber growing and harvesting in lodgepole pine and to the smooth functioning of the organization have been most outstanding", Clark said.

FORESTER

Approved for use by U. S. Forest Service

Seal-Tite

DRIP-TORCH

Proved superior in over 8 years of field service

★

No Flash-back
No fuel slopping
No air pump
No pressure build-up
No explosive vapors
No pre-heating
Instant operation

★

SAFE • EFFICIENT
RELIABLE • ECONOMICAL

★

Burns Diesel Fuel or Stove Oil
1¼ Gallon Capacity
Weight loaded 16 pounds

U. S. Patent No. 2376976

Write for descriptive folder and price list.

WESTERN FIRE EQUIPMENT CO.
69 Main St., SAN FRANCISCO, California

MUSSER TREES are GROWING IN ALL 48 STATES!

20 Million TREES a year!

Every year our large teams of hard-working MUSSER tree planters start more than 20 million more trees on the way to hardy, healthy and successful treehood: Seedlings for Forest and Christmas Tree plantings; Transplants for Conservationists, Timber Operators and Farmers. MUSSER customers KNOW they will receive trees that have the RIGHT START. Further, we offer about the widest selection of Quality plus Volume to be found in the world today. You will profit from the economies our huge volume makes possible.

SPECIAL SCOTCH PINE
2 yr. seedlings 4"-7"
$35 per 1000
NORWAY SPRUCE
(MUSSER Special)
2 yr. seedlings 5"-10"
$35 per 1000
WHITE PINE
2 yr. seedlings 2"-4"
$20 per 1000
DOUGLAS FIR
3 yr. seedlings 10"-14"
$40 per 1000

At right are a few of our low quantity prices:

Also shade and hardwood seedlings. Write today for Christmas Tree Growers' Guide and complete wholesale stock list; or tell us your requirements.

MUSSER FORESTS, INC.
Box 26-G INDIANA, PA.

SEEDS FOR NURSERYMEN

TREE — SHRUB — PERENNIAL —
FLOWER — VEGETABLE

Correspondence with Seed Collectors Invited

Herbst Brothers Seedsmen, Inc.
Established 1876

578 BROADWAY NEW YORK 12, N. Y.

We Will Pay For Society Publications

Through member donations, and purchases from members, the Society hopes to rebuild its publications file of currently out-of-print, or low-supply issues of the *Forestry Quarterly, Proceedings, Journal of Forestry,* and first *Cumulated Index* (1902-1929). Donations of needed issues will be gratefully received. But the Society will allow credit on a member's dues in the amount and for the issues indicated below.

When sending back copies be sure to indicate if they are donated.

FORESTRY QUARTERLY

(25c for each needed copy)

Vol. 1, Nos. 3 and 4 (April and July 1903); Vol. 2, Nos. 1, 2, 3 (November 1903 and February and May 1904); Vol. 6, Nos. 1 and 4 (March and December 1908); Vol. 10, No. 4 (December 1912); and Vol. 12, No. 1 (March 1914).

PROCEEDINGS

(25c for each needed copy)

Vol. 5, No. 1 (1910); Vol. 8, Nos. 1 and 2 (April and July 1913); Vol. 9, Nos. 1, 2, 3 (January, April, and July 1914).

JOURNAL OF FORESTRY

(25c for each needed copy)

Vol. 18, Nos. 1 and 4 (January and April 1920); Vol. 22, No. 8 (December 1924); Vol. 24, No. 4 (April 1926); Vol. 26, No. 1 (January 1928); Vol. 27, No. 1 (January 1929); Vol. 40, No. 4 (April 1942); Vol. 44, No. 2 (February 1946); and Vol. 45, No. 11 (November 1947).

JOURNAL OF FORESTRY

(50c for each needed copy)

Vol. 15, No. 1 (January 1917); Vol. 16, No. 1 (January 1918); Vol. 22, No. 2 (February 1924); Vol. 24, No. 5 (May 1926); Vol. 25, No. 1 (January 1927); Vol. 30, No. 6 (October 1932); Vol. 44, No. 1 (January 1946); Vol. 45, Nos. 2 and 12 (February and December 1947); Vol. 47, No. 7 (July 1949); Vol. 49, Nos. 1, 3, and 4 (January, March, and April 1951); and Vol. 50, Nos. 1 and 4 (January and April 1952).

CUMULATED INDEX

50c for each copy first *Cumulated Index* (1902-1929) for the Journal of Forestry.

Indicate clearly copies of the Society's publications which are donated. Send to

SOCIETY OF AMERICAN FORESTERS

Mills Building

Washington 6, D. C.

W. W. DRESSKELL

Secretary Benson Announces Reorganization of Department Information Work

Secretary of Agriculture Ezra Taft Benson has announced a reorganization of the information work of the Department of Agriculture. The changes include: a regrouping of the work of the present six media divisions of the Office of Information into three general activities of current information, publications, and visual work; establishment of more clear-cut policy control of all publications issued by the Department; centralization of art, graphics, and photographic work which is now performed in numerous parts of the Department; and removal from agency information divisions of work which is determined to be "non-information" in character.

J. L. SEVY

New Assignments for W. W. Dresskell and J. L. Sevy

Two Intermountain Region foresters have received transfers and promotions, as announced by Regional Forester C. J. Olsen, effective June 6.

W. W. Dresskell, supervisor of the Bridger National Forest since 1950, with headquarters at Kemmerer, Wyo., has been selected to be assistant chief of the Division of Range Management for the Forest Service with headquarters in Washington, D. C.

J. L. Sevy, who has been "Acting" in charge of the Forest Service Intermountain Regional Division of Fire Control in Ogden, will be promoted to supervisorship of the Bridger forest.

Dresskell received his B. S. degree in range and timber management from the University of Montana in 1936. He has been employed by the Forest Service since that year.

In 1947 he was selected to take charge of the Forest Service reseeding program for the 19 national forests of the Intermountain Region. He is a member of the American Society of Range Management and the S.A.F.

Sevy was graduated from the Utah State Agricultural College with a B.S. degree in forestry in 1937.

He was appointed staff assistant in charge of range management on the Boise in 1947 and was promoted to assistant supervisor of the Manti-La-Sal National Forest in Utah in 1949.

In 1950 he was selected to head the reseeding activities of the Intermountain Region. He was made "Acting Chief" of Forest Fire Control for the region in 1953.

Sevy is an active member of the S.A.F. and the American Society of Range Management.

Lee Kirby Retires

Lee Kirby, watershed management analyst for the Rocky Mountain Region of the U. S. Forest Service in Denver, has retired following 45 years as ranger, supervisor, and watershed expert in the southwestern and intermountain states.

Announcing Kirby's retirement, Regional Forester Donald E. Clark stated that during Kirby's long years of service, he has become widely known as one of the great advocates of preventing floods and increasing water production through proper management

of the land on which water falls.

In 1909 Kirby entered the Forest Service as a forest guard on the Crook National Forest at Globe, Arizona. He was promoted to assistant forest ranger in 1910, and became a ranger the year following. He has served as supervisor of the Tonto, the Coconino, the Datil, and the Sitgreaves National Forests. Following a one year assignment in the Washington office of the Forest Service, Kirby transferred to Denver as Watershed Management Analyst in the Regional Division of Recreation, Lands, and Watershed Management.

Richard Kilbourne Heads TVA Forestry Relations on Retirement of W. M. Baker

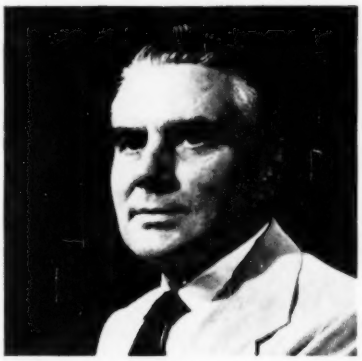
The Tennessee Valley Authority Board of Directors on April 30 approved the retirement application of Willis M. Baker, director of the Division of Forestry Relations for 16 years, and named Richard Kilbourne, assistant director, to succeed him.

Mr. Baker had been with TVA as director of forestry activities since 1938. A native of Pennsylvania, he was graduated from the Pennsylvania State University in 1914 with a bachelor degree in forestry. He worked with the U. S. Forest Service in Arizona for three years and then with the New Jersey Department of Conservation and Development until 1930. He next served two years as director of the Pennsylvania Forest Research Institute at Mont Alto and seven years as director of the Central States Forest Experiment Station at Columbus, Ohio. All of his 40 years in forestry have been devoted to public service.

Mr. Baker is a Member of the Society of American Foresters, and served two terms on the S.A.F. Council.

Mr. Kilbourne went to TVA in November 1933, and became assistant director of the Division of Forestry Relations in 1945. He earned a master's degree in forestry at Yale University in 1926 following undergraduate study at Washburn University in his native Kansas. He spent four years with the Tennessee Division of Forestry as assistant forester in charge of reforestation, and from 1931 to 1933 was employed by the Maryland Forest Service and the University of Maryland as state extension forester. From 1942 to 1945, he served in the Pacific in the U. S. Marine Corps.

WILLIS M. BAKER



RICHARD KILBOURNE

Allied

Forest Products Research Society Meets

The Eighth National Meeting of the Forest Products Research Society was held in Grand Rapids, Mich., May

COLORED SLIDES

Will exchange 2¼" x 2¼" colored slides of trees that grow in your state for those from my state.

Ask for details.

Tyree Trobaugh • Box 4, Young, Ariz.

BAKED ENAMEL

METAL FORESTRY SIGNS

for WOODLAND BOUNDARY MARKERS — NO TRESPASSING & FIRE WARNING SIGNS — CRUISER TAGS, etc., etc., made to your specifications. Write for quotations on all your sign needs.

A. L. LIND COMPANY
5036 Thomas Ave. So.
Minneapolis 10, Minnesota

America's No. 1 Spray-On INSECT REPELLENT

Protects Against CHIGGERS MOSQUITOES BLACK FLIES TICKS

LIST PRICE 98¢

A simple misting will impregnate clothing so insects can't attach themselves to pants, socks, shirts, etc., and then work their way through to the body. Ideal for fishermen, hunters, gardeners, picnickers, campers, all outdoor people. A few seconds spray protects all day.

At Drug, Hardware & Sports Stores

Calders' Forest Road
ENGINEERING TABLES

Complete tables for field work on waterproof paper and acetate cover. Sent on approval Price 5.00

LESTER E. CALDER and DOUGLAS G. CALDER
1828 Hilyard St. Eugene, Oregon

TWO HANDY FIREFIGHTERS

The Portable Hale FZZ Centrifugal Pumping Unit pumps from draft up to 60 GPM at 90 lbs. Its companion Centrifugal, Type HPZZ, shown above, pumps 15 GPM at 200 lbs.

These compact, sturdy, quick-starting units are "workhorses" for fighting forest, brush and field fires. One state forestry department has over fifty of them in service. Their 4 cycle aircooled 8¼ H.P. engine is easy to start in any kind of weather.

For Detailed Information Write:

HALE FIRE PUMP CO.
CONSHOHOCKEN, PA.

K+E

FROM EVERY ANGLE

Traditional K&E care and precision go into the making of these useful forestry instruments . . . K&E Right Angle Instruments and The K&E Hand Level with a right angle feature.

These instruments are *rugged* . . . designed to stand up without the need of constant adjusting even under the rough usage of forest work.

THE RIGHT ANGLE PRISM

This compact instrument consists of a single ground triangular prism and it, therefore, cannot get out of adjustment. A plumb bob can be attached to the hook of the handle.

THE RIGHT ANGLE MIRROR

This instrument gives a slightly larger field of view and is adjustable. As an added feature, a small plumb bob is conveniently stowed in the handle.

THE DOUBLE RIGHT ANGLE PRISM

Consisting of two ground pentaprisms separated by a plano-parallel element, it can be *placed on a line between two points* and a third point at right angles can be sighted. A plumb bob can be attached or the instrument can be mounted on a staff.

THE HAND LEVEL WITH A RIGHT ANGLE FEATURE

Here is a dual-purpose instrument with all of K&E's famed precision. While its principal use is as a hand level, it offers the right angle feature as well. Note the flat base permitting use on a level board.

Ask any K&E Distributor or Branch for further information or write Keuffel & Esser Co., Hoboken, N. J.

KEUFFEL & ESSER CO.
EST. 1867
Drafting, Reproduction, Surveying Equipment and Materials, Slide Rules, Measuring Tapes.
New York • Hoboken, N. J.
Detroit • Chicago • St. Louis
San Francisco • Los Angeles • Montreal

4-8 in cooperation with the Woodworkers' Industry Show. Over 830 persons registered for the F.P.R.S. meeting with an estimated 5,000 for the Industry Show.

Field trips to wood-using industries supplemented the technical sessions and social events.

New officers are: president, Lester J. Carr, L. J. Carr Co., Sacramento, Calif., who automatically succeeded to the presidency; president-elect, M. B. Christian, Chicago Mill & Lumber Co., Tallulah, La.; vice president, Ralph H. Bescher, Koppers Co., Pittsburg, Pa. John D. Ritchie, Douglas Fir Plywood Association, Tacoma, Wash., was elected northwest regional board member; and Frank T. Parrish, Heywood-Wakefield Co., Gardner, Mass., as northeast regional board member. Elected to serve on the 1955 nominating committee were: A. B. Anderson, University of California School of Forestry; G. G. Marra, Washington State Institute of Technology; Herbert B. McKean, Potlatch Forests, Inc.; and Frederick F. Wangaard, Yale School of Forestry.

The 1955 national meeting will be held June 20-23 in Seattle, Wash.

F.F.A. Holds Southern Forestry Conference

A total of 300 persons from the Forest Farmers Association's 15-state area turned out for the 1954 Southern Forestry Conference at Asheville, N. C., on April 26-27.

Dr. R. E. McArdle, chief of the U. S. Forest Service delivered the keynote address, based on the conference theme, "Trends in Southern Forestry". Earlier the group had heard words of welcome from North Carolina Governor William B. Umstead's personal representative; Mayor Earl W. Eller of Asheville; State Forester Fred Claridge; N. C. Forestry Association President Roger W. Wolcott; Lowell Besley, executive director of the American Forestry Association; Walter J. Damtoft of Champion Paper and Fibre Co. and Forest Farmer regional vice president; and R. W. Graeber, Forest Farmer director for North Carolina.

The annual conference luncheon followed the keynote address and featured the association's annual report, presented by President J. V. Whitfield. The first annual Forest Farmer Award for "an outstanding contribution to private forestry endeavor and full forest development" was presented to Earl M. McGowin of Chapman, Ala., well-known in the lumber industry and present director of the Alabama Department of Conservation. D. J. Weddell, chairman of the awards committee, made the presentation. Principal banquet speaker on Tuesday evening was A. W. Bentley, consulting forester of Athens, Tenn.

The 1955 Conference will be held at Biloxi, Miss., at a date to be announced.

Trail Riders of the Wilderness Start Third Decade

In 1933 the American Forestry Association began the annually organized wilderness expeditions know as Trail Riders of the Wilderness. Since that time about 2,600 men and women have participated in the 142 expeditions that have explored 15,000 miles of wilderness trails.

This year between July 5 and September 19, eleven expeditions will be held in the lake country of the North and mountain wildernesses of the West.

Individual parties are kept small, usually about 25 persons, are outfitted by expert guides and packers, and include an official representative of the Association and a medical officer. These expeditions are operated by the Association as a part of its educational service and on a non-profit basis; the riders sharing equally the costs of the trips. They represent a means by which any man or woman, or older child, in a normal state of health and with an average amount of outdoor experience may, at costs ranging from $195 to $215, enjoy wilderness country under experienced and organized leadership.

The address of the American Forestry Association is 919 17th St. N. W., Washington 6, D. C.

Education

Western Forestry Clubs Hold Third Annual Meet

The Association of Western Forestry Clubs held its Third Annual Conclave at Oregon State College, Corvallis, April 29 through May 1.

The association is composed of the eight forestry clubs located at the University of Washington, Washington State College, University of Idaho, Montana State University, Colorado A & M, Utah State Agricultural Col-

lege, University of California, and Oregon State College. The purpose of the association is to promote fellowship between the forestry clubs of the western United States and to exchange ideas of club activities.

Featured speakers at the 3-day event were former Oregon Governor Charles A. Sprague and Lyle F. Watts, retired chief of the U. S. Forest Service. The program also included committee meetings to discuss club activities, constitution, publications, Conservation Week, and student-faculty relationships; outdoor contests; and social events.

Business and Resources Degree Combination Offered at Michigan

A combined study program leading to degrees in both business administration and natural resources has been announced by University of Michigan Deans Russell A. Stevenson and Stanley G. Fontanna.

Under terms of the program, a bachelor's degree is awarded by the School of Natural Resources for four years work in its courses. A student who has finished this curriculum, and also had the proper choice of electives, can then earn a Master of Business Administration degree in one additional year.

Dean Fontanna of the natural resources school points out the program's interest to foresters and others in resource management because "the production and utilization of natural resources requires a high degree of competence in both technological and business areas." He adds that "this is particularly true for the many positions of executive and administrative responsibility in both private industry and public service."

Such a combined program is made possible through the many courses offered in natural resources which have a close relationship to business and serve as a foundation for work in the School of Business Administration.

Up to 15 semester hours of advanced standing in business administration is given for specific courses relating to business offered in forestry, wood technology, conservation, and fisheries in the natural resources school. An additional 15 hours of courses in the School of Business Administration are taken as electives.

This 30-hour total gives a student the maximum advanced standing credit with which a student can enter the School of Business Administration as a master's degree candidate.

Private & Industrial

St. Regis Fellowship Awarded to P. R. Larson

St. Regis Paper Company announces the award of its Fellowship in Forestry to Philip R. Larson who is currently engaged in silvicultural research for the Southeastern Forest Experiment Station in Lake City, Florida. Larson holds the B.S. and M.S. degrees from the University of Minnesota and plans to enter the Yale University Graduate School in the fall to study for his Ph. D. degree under the direction of the School of Forestry.

Larson's proposed doctoral thesis is directed primarily toward the pulp and paper industry and will deal with the effect of certain climatic and environmental factors on the wood density and proportion of summerwood in slash pine.

This is the second St. Regis Fellowship in Forestry to be awarded to degree holders planning to take graduate work at any accredited school of forestry in the United States. St. Regis also offers five undergraduate scholarships in forestry, effective in the academic year 1954-55.

The committee responsible for making the graduate award was composed of R. E. McArdle, chief, Dr. V. L. Harper and Herbert Stone, assistant chiefs of the U. S. Forest Service; W. R. Adams, vice president of St. Regis; Gen. Sanderford Jarman, Washington representative of St. Regis; and A. B. Recknagel, St. Regis forestry consultant.

Three of the undergraduate scholarships, for which applicants may file up to September 1, 1954, are available in the South, and one each in the Northwest and Northeast.

The scholarships in the South are being provided, one each, at Alabama Polytechnic Institute, University of Florida, and University of Georgia. Each amounts to $800 a year for a period of two years, and will be awarded to an outstanding junior student in forestry at the above schools. Like scholarships are being offered to outstanding junior forestry students at the University of Washington or Oregon State College in the Northwest, and the University of Maine, University of New Hampshire, University of Massachusetts, or the New York State College of Forestry in the Northeast.

COMPLETE INVENTORY CRUISING SCALE

Hypsometer
Biltmore Scale
Rigid When Open
Flexible 6-foot Steel Tape $3.00 EACH
Handy Chrome-plated Case 1¾" Dia.
IMMEDIATE DELIVERY
CARL W. GETZ, *President*
KURFEW, INC.
Lansdale, Pa.

BARTLETT TREE TRIMMERS

Powerful compound lever cutting head has capacity of 1¼ in.

One-piece poles to 16-ft. or sectional poles as required.

Send for catalog No. 34

BARTLETT MFG. CO
3015 E. Grand Blvd. DETROIT 2, MICH.

3 Patents. Best material. Sold by the thousands.

Infringers and imitators warned.

Best Chrome Steel—Strong, Durable

THE RENOWNED
CHARLES H. RICH
"Forest Fire Fighting Tool"
Write for Prices and Descriptions
Geneva Rich Bickel WOOLRICH, PA.

"This was LOGGING!"
FREE with the coupon below—a brochure to cherish—12 page sample section from the forthcoming book of timber treasure—"THIS WAS LOGGING!"
Photographic classic of the lusty and colorful Pacific Northwest logging from 1890 to 1940—from the 3000 print lifework of DARIUS KINSEY with biographical text.
SEND COUPON NOW
SUPERIOR PUBLISHING CO.
P. O. Box 2190
Seattle, Washington
Send me FREE 12 pages "This Was Logging!" Attached is list of friends also interested.
Name
City

Index to Advertisers

	Page
Allis Chalmers	543
Atkinson, S. Gayley	554
Banzhaf & Co., George	554
Bartlett Mfg. Co.	559
Bernard Food Industries	544
Calder, Lester E. and Douglas G.	557
Caterpillar Tractor	Third Cover
Chapman Chemical	547
Dimension Mill Equipment	552
Dow Chemical	482
Eastman, Wm. A.	554
Forestry Suppliers	551
Hale Fire Pump	557
Hall, A. G.	554
Herbst Brothers Seedsmen	555
Homelite	Back Cover
Keuffel & Esser	558
Kurfew	559
Lemieux, Frank J.	554
Lind Co., A. L.	557
Lowther Co., Harry A.	544
Lufkin Rule	545
McGraw-Hill	553
Melin Meteorological Service	550
Meriam Co., L. W.	550
Musser Forests	555
Nelson Co.	549
Pacific Marine Supply	546
Pond & Moyer	554
Prentiss & Carlisle	554
Rich Forest Fire Tool	559
Sandvik	552
Schultz & Co., C. D.	554
Sebrell Corp., J. B.	550
Sewall Co., James W.	554
Silva	544
Smith, A. R.	544
Smith Co., D. B.	Second Cover
Southern Coatings & Chemical	548
Southern Seed	550
Sunerest Evergreen	560
Superior Publishing Co.	559
Trobaugh, Tyree	557
Twin City Welding & Machine Shop	545
Western Fire Equipment	555
Whitmire Research Laboratories	557

St. Regis will offer to each of the undergraduate scholarship winners employment during the intervening summer on some forestry project. Their continuance as recipients during the senior year will depend upon their records in the field as well as in school.

The Fellowship in Forestry, valued at $1,000, covers only one year and the award winner is expected to direct his studies along lines of value to the pulp and paper industry.

Olympic Tree Farm Has New President

Directors of the South Olympic Tree Farm in March installed H. O. Puhn, general production manager of the Simpson Logging Co., Shelton, Wash., as president of the tree farm for 1954. He succeeds George L. Drake, Simpson vice president and past S.A.F. president, who had headed the tree farm organization since its founding in 1943.

Tree farm directors, in addition to Mr. Drake, who will continue in that capacity, include Clyde T. Martin, Weyerhaeuser Timber Co., also an S.A.F. past president; Robert Sackerson, Milwaukee Land Co.; and Charlie Cowan, Washington Forest Fire Association. Oscar Levin is in his 11th year as managing forester of the tree farm.

H. G. Lambert to New Orleans AFPI Post

Appointment of Herbert G. Lambert, Jr., of New Orleans as district manager of the New Orleans office of American Forest Products Industries, Inc., has been announced by Charles A. Gillett, AFPI managing director, Washington, D. C.

Mr. Lambert, a graduate of Louisiana State University School of Forestry, succeeds Franklin Bradford, former Dallas, Texas, newspaperman recently transferred to AFPI headquarters in Washington as assistant editorial director.

Prior to joining AFPI, Lambert was employed in the advertising department of an oil company in New Orleans. He is an Air Force veteran of World War II and also served in Korea.

Lambert will have charge of all AFPI activities in the states of Louisiana, Texas, and Mississippi.

Products and Equipment

Wood Treated With Preservatives in 1953

Approximately 300,188,000 cubic feet of wood materials were treated with preservatives such as creosote, coal-tar, petroleum, pentachlorophenol, and chromated zinc chloride during 1953, the Department of Agriculture has announced in a report, issued by the Forest Service in cooperation with the American Wood Preservers' Association.

Although the report is preliminary, indications are that the amount of wood treated in 1953 was five percent less than the 314,998,000 cubic feet of material treated in 1952.

New Wood Preserver

Users of wood preparations composed of crystalline materials are often confronted with the problems of "blooming" on the surface; irritation of the skin of workmen; lack of effectiveness during cold weather; and inability to paint wood directly after treatment. Pentox, containing Pentachlorophenal plus Rosin Amine D, a new wood preserver, appears to solve these problems. It is a resinous instead of a crystalline material available from Osmose Wood Preserving Co. of America, Inc., 980 Ellicott Street, Buffalo, N. Y.

GROW TREES
FOR XMAS TREES AND FORESTRY
Fir, Pine and Spruce in Variety
Seedlings and Transplants
Write for Price List
Suncrest Evergreen Nurseries
P. O. Box 643, Johnstown, Pa.

Forestry Employment

Positions Wanted

Forester, graduate New York State Ranger School, 1943; B.S.F. New York State College of Forestry, 1948. Age 31, married, two children. Captain, active duty Air Force; available for work September 1, 1954. Hold commercial pilot license. Will consider any position in management or allied fields.
John W. Rockafellow, 2811 Stafford St., Bossier City, La.

Forester, B.S.F. North Carolina State College, 1950, married, 33. Over 3 years experience in procurement and management cruising and marking for sawtimber and pulpwood in the south. Location preferred East or Southeast.
Box A, Journal of Forestry, Mills Building, Washington 6, D. C.

REDUCES FIRE HAZARDS

—and costs!

ON THIS selective logging operation at Nasty Creek, Washington, the Cascade Lumber Co. is using a Caterpillar D6 Tractor with Fleco root rake to pile brush and slash. Also in the company's line-up on this job are two D7s and another D6. Clayton Wimer, Cascade's Yakima Logging Super, says: "The D6 is the ideal machine for this work. It's very efficient and easy to handle."

From piling brush (to reduce fire hazards) to building fire trails, CAT* Diesel Tractors with rakes or bulldozers deliver steady production at low cost. Sturdily built, they take the rough going of routine woods work in stride. Horsepower, weight and speed are *matched* for maximum performance. Low-effort steering gives the operator positive control and visibility is excellent for maneuvering—both assets in tight spots. On any job, you can figure one of these rugged yellow machines to do more work at lower cost with less down time than any competitive unit in its class.

Always known for their stamina, Caterpillar D6, D7 and D8 Tractors now have even greater endurance than before. Here's why. They now come equipped with the new oil-type clutch, a major advance in tractor design. This clutch enables you to operate these units much longer between adjustments and replacements than the conventional dry clutch!

Get the full facts from your nearby Caterpillar Dealer, a reliable source of service and information. Ask him for proof of money-saving performance—have him demonstrate on your job.

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

CUT COSTS WITH CAT DIESEL TRACTORS

BRAKE* hp 22 pounds
Model 17
The highest quality saw at the lowest possible price.
BRAKE* hp 27 pounds
HOMELITE
There's a
HOMELITE
One-Man Chain Saw for Every Type of Woodcutting Operation
Model 26
Famous for its performance and low operating cost.
BRAKE* hp 30 pounds
Homelite gives you the most complete line of high quality one-man chain saws . . . saws for every type of woodcutting operation from felling big trees 5 feet or more in diameter to cutting pine into pulpwood sticks. And each and every one of these saws is designed and built to give faster cutting, easier handling and extra dependability in the woods. A wide range of straight blades and plunge cut bows available.
Prices start at $259.00 complete.
Write or send coupon for complete information.
Model 5-30
More power, faster cutting than any other one-man saw.
*Actual dynamometer rated horsepower
Manufacturers of Carryable Pumps • Generators • Chain Saws
HOMELITE CORPORATION, 4107 Riverdale Ave., Port Chester, N. Y.
Canadian Distributors: Terry Machinery Co., Ltd., Toronto, Montreal, Vancouver, Ottawa.
Please send me complete information on Homelite chain saw
Model 17 ☐ Model 26 ☐ Model 5-30 ☐
Name .....
Address .....
Town ..... County ..... State .....